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Smith et al.

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(54) **COMMUNICATION DEVICE WITH A
DUAL-SIDED LIQUID CRYSTAL DISPLAY**

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U.S.C. 154(b) by 0 days.

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(52) **U.S. Cl.** **455/566; 455/550; 349/67;**
349/113

(58) **Field of Search** **455/569, 566,**
455/90, 550, 575; 345/864; 349/113, 11,
17, 67, 69

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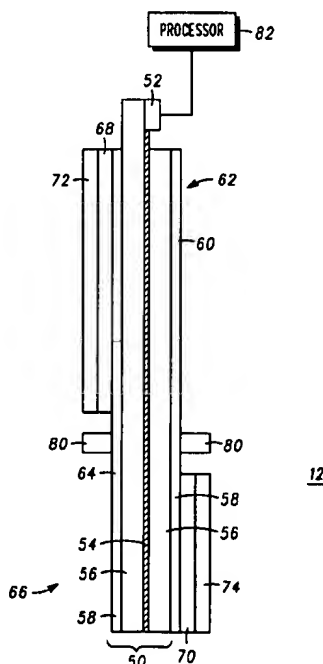
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(57) **ABSTRACT**

A communication device (10) with a dual-sided liquid crystal display (12) located with a housing (14) having two viewports (18,22). The display (12) includes a liquid crystal panel (50) with an associated driver circuit (52). The panel (50) has a first side (60) for viewing a top portion (62) of the display (12) from the first viewport (18) and a second side (64) for viewing a bottom portion (66) of the display (12) from the second viewport (22). A top reflective layer (68) is disposed on the top portion (62) of the panel (50) on the second side (64) of the panel (50). A bottom reflective layer (70) is disposed on the bottom portion (66) of the panel (50) on the first side (60) of the panel (50). A processor (82) is coupled to the driver circuit (52), wherein the processor (82) directs the display (12) through the driver circuit (52) to provide user interface information for operating the communication device (10). The present invention provides a dual-sided display (12) on a single LCD panel (50) using one driving circuit (52).

15 Claims, 3 Drawing Sheets



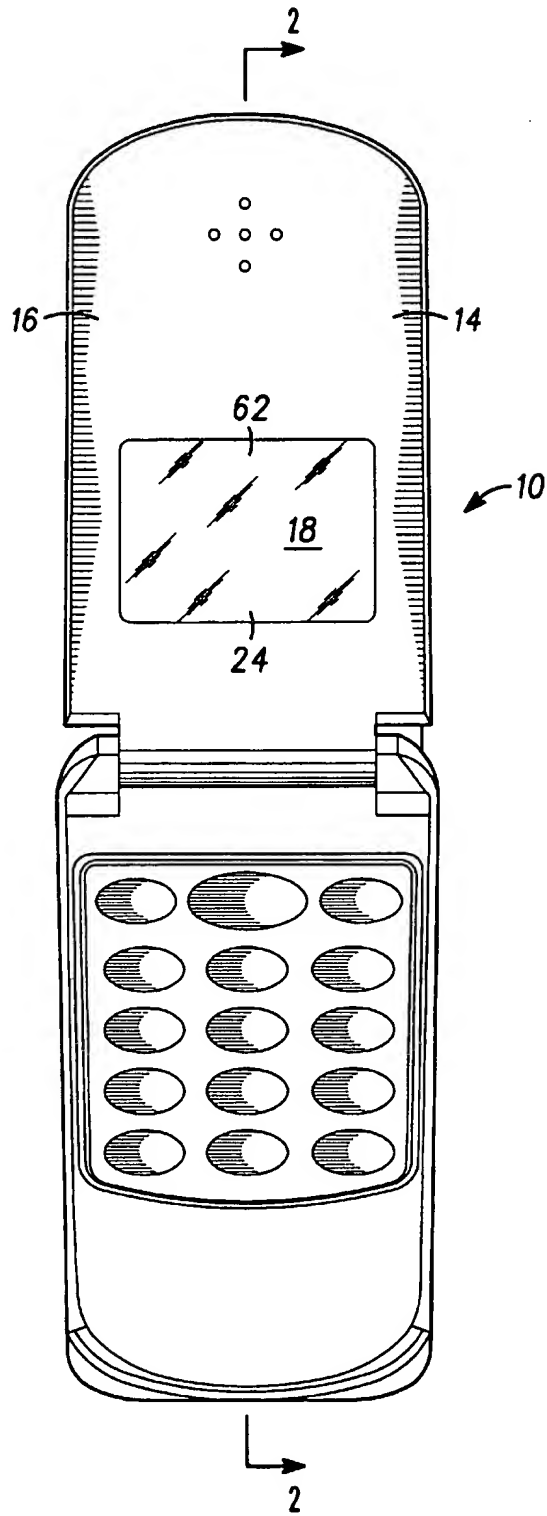


FIG. 1

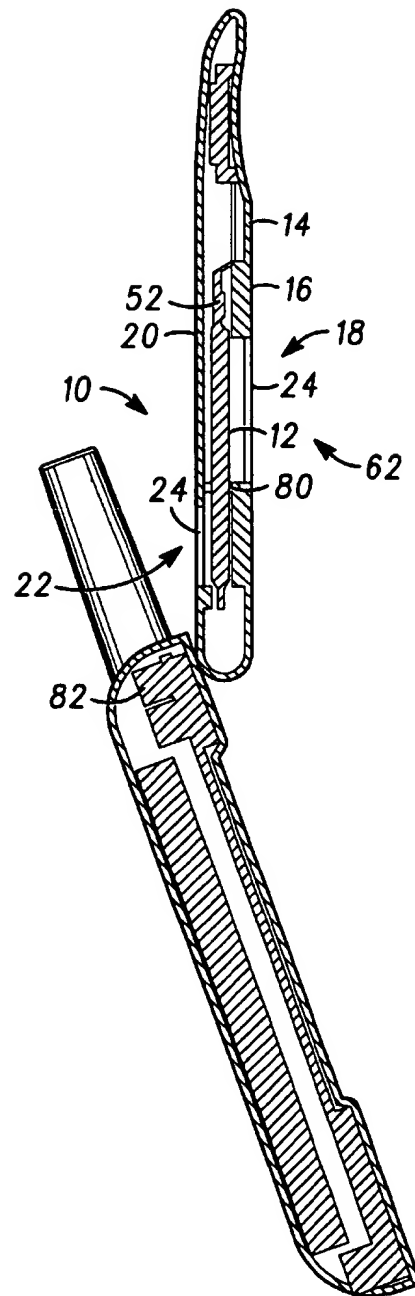
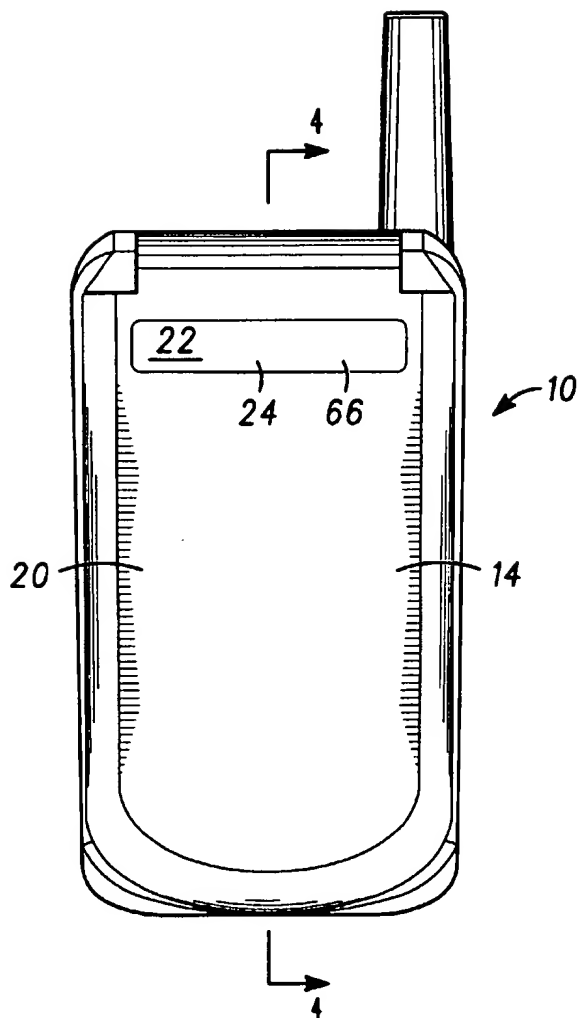
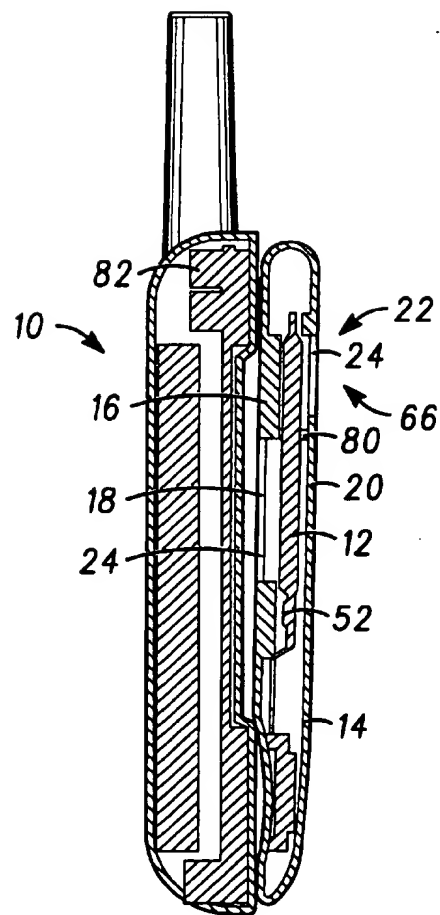
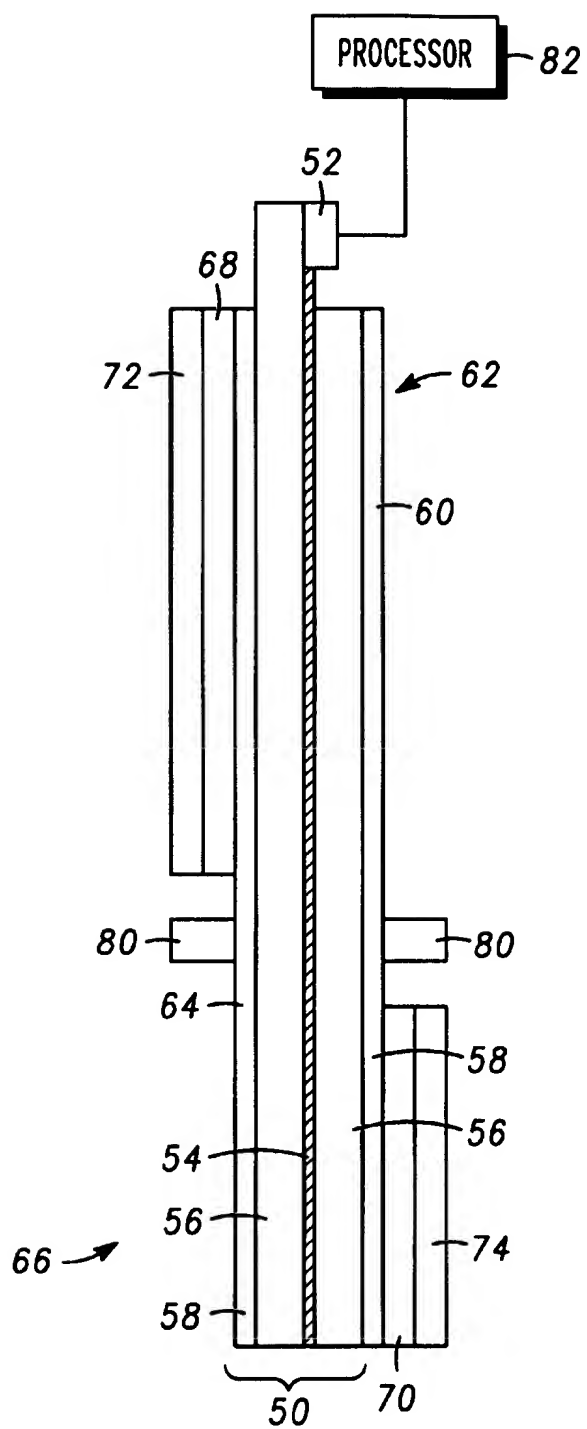


FIG. 2

**FIG. 3****FIG. 4**

**FIG. 5**

1

COMMUNICATION DEVICE WITH A DUAL-SIDED LIQUID CRYSTAL DISPLAY

FIELD OF THE INVENTION

The present invention relates generally to wireless communication systems. More particularly, the invention relates to a user interface display interface for a communication device.

BACKGROUND OF THE INVENTION

Many portable communication devices, such as cellular telephones, include a housing defining relatively large front and rear surfaces with thin sides. Such devices may be thin enough to fit within a pocket of clothing or to carry on a belt or a holster. Typically, the device has a user interface that includes one or more components such as a keypad or a display. When the device is carried as described above, the user interface may not be very accommodating to a user. For example, when such a device is carried on a belt of a user, the user interface can be completely or partially obstructed from the user's view.

In addition, some devices have flaps which cover the user interface for protection against various elements such as dirt or rain, or for other reasons such as for protection against inadvertent actuations at the keypad. Although highly beneficial, such flaps may similarly or further inhibit viewing of the user interface. For example, the display and keypad can be partially or completely covered preventing the user from discerning the status of the device unless it is removed from its holder and physically opened.

Accordingly, what is needed is a communication device having a user interface that is more accommodating to a user, and additionally one that does not substantially increase power consumption, driving circuitry, or cost of the communication device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a communication device in an open position and having a display, in accordance with the present invention;

FIG. 2 is a cross-sectional side view of the communication device of FIG. 1;

FIG. 3 is a front view of a communication device in a closed position and having a display, in accordance with the present invention;

FIG. 4 is a cross-sectional side view of the communication device of FIG. 3; and

FIG. 5 is a simplified side view of a preferred embodiment of a display for a communication device, in accordance with the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a radio communication device that provides a dual sided display allowing a user the option of hands-free status of communication activities. The dual-sided display uses a single LCD panel and single driving circuit. This reduces size, weight, circuit complexity and cost.

The invention will have application apart from the preferred embodiments described herein, and the description is provided merely to illustrate and describe the invention and it should in no way be taken as limiting of the invention.

2

While the specification concludes with claims defining the features of the invention that are regarded as novel, it is believed that the invention will be better understood from a consideration of the following description in conjunction with the drawing figures, in which like reference numerals are carried forward. A radiotelephone is a communication device that communicates information to a base station using electromagnetic waves in the radio frequency range. The radiotelephone can be strapped to, or otherwise secured to, a person's belt or other holder.

The radiotelephone portion of the communication device is preferably a cellular radiotelephone adapted for personal communication, but may also be a pager, cordless radiotelephone, or a personal communication service (PCS) radiotelephone. The radiotelephone portion may be constructed in accordance with an analog communication standard or a digital communication standard. The radiotelephone portion generally includes a radio frequency (RF) transmitter, a RF receiver, a controller, an antenna, batteries, a duplex filter, a frequency synthesizer, a signal processor, and a user interface including at least one of a keypad, control switches, and a microphone. The radiotelephone portion can also include a paging receiver. The electronics incorporated into a cellular phone, two-way radio or selective radio receiver, such as a pager, are well known in the art, and can be incorporated into the communication device of the present invention.

FIGS. 1-5 illustrate a communication device according to the present invention. By way of example only, the communication device is embodied in a cellular phone having a conventional cellular radio transceiver as is known in the art and will not be presented here for simplicity). The cellular telephone, includes conventional cellular phone hardware (also not represented for simplicity) such as a battery, processor, and user interface that is integrated in a compact housing, and further includes an dual-sided display, in accordance with the present invention.

The present invention includes a communication device 10 with a dual-sided liquid crystal display 12. The present invention includes a housing 14 for holding the display 12. The housing 14 has a first side 16 with a first viewport 18 and a second side 20 with a second viewport 22. Preferably, the viewports 18,22 of the housing 14 are covered with substantially transparent lenses 24 to keep out dust and dirt. Preferably, the housing 14 comprises a movable portion of the communication device 10 wherein the second viewport 22 is visible when the housing 14 is closed against the communication device 10 covering the first viewport 18, as represented in FIGS. 3 and 4. When the housing 14 is open both viewports 18,22 are visible with the first viewport 18 visible on the first side 16 of the housing 14 and the second viewport 22 visible on the second side 20 of the housing 14. Although the display is shown in a movable flip housing portion of the communication device, it should be recognized that the present invention could also be incorporated into a suitably thin communication device with a one-piece housing.

As represented in FIG. 5, the liquid crystal display of the present invention includes a liquid crystal panel 50 with an associated driver circuit 52, as is known in the art. The panel 50 includes a layer of liquid crystal material 54 sandwiched between two substantially transparent plates 56 and between polarizers 58. The polarizers 58 have perpendicular axes of polarization. Transparent electrodes (not shown) are affixed to the inner surfaces of the transparent plates 56 to alter the light transmission properties of the liquid crystal material 54 of the panel 50. In this manner, the electrodes define pixels

3

that create the display. As used herein, pixels refer to a region of the liquid crystal panel that form light or dark areas in the panel when viewed from the side and when the associated electrodes in those areas are energized or de-energized. The pixels can be arranged in an array to form a graphical display or the commonly used figure-eight arrangement utilized for alphanumeric characters. In the present invention, the panel 50 has a first side 60 for viewing a top portion 62 of the display 12 from the first viewport 18 and a second side 64 for viewing a bottom portion 66 of the display 12 from the second viewport 22.

In the absence of an applied electric field, polarized light is admitted through one polarizer and reoriented by the liquid crystal layer 54 to pass through the opposite polarizer, thereby causing the panel to be transparent and creating a bright pixel for the display. However, where an electrical potential is applied between electrodes on either side of the pixel, this alters the liquid crystal layer 54 to prevent light from passing through the panel, thereby creating an opaque region in the panel that appears as a dark pixel. By selectively applying electrical current to the electrodes, pixels can be individually switched between a transparent or bright state and an opaque or dark state. While the liquid crystal panel 50 creates a display by locally altering light transmission in each pixel, the liquid crystal panel does not generate the light needed for viewing the display. There are two approaches for providing light for the display.

In a first embodiment of the present invention, ambient light is used to light the display. A top reflective layer 68 is disposed on the top portion 62 of the panel 50 on the second side 64 of the panel 50. A bottom reflective layer 70 is disposed on the bottom portion 66 of the panel on the first side 60 of the panel 50. The reflective layers 68,70 face the back side of the panel opposite their respective viewing portions 62,66. At a transparent area, ambient light is filtered through a first polarizer, traverses the panel 50, is reflected back by the associated reflective layer, and re-traverses the panel to create a bright pixel. Of course, at an opaque area light does not traverse the panel creating a dark pixel.

In a second embodiment of the present invention, light sources 72,74 illuminate the back of the viewing portions 62,66, whereupon the light from the light source 72,74 is screened by the back polarizer and traverses transparent regions of the panel to create bright pixels. Preferably, the light sources are electroluminescent panels, as is known in the art. The reflective layers and electroluminescent panels provide top and bottom display regions 62,64 sized to substantially fill their associated viewing ports 18,22. It is also preferred that the first embodiment be incorporated into the second embodiment. In this way alternative light resources can be used to the best advantage of each, i.e. the reflective properties of the first embodiment are best used in high ambient light and the transmissive properties of the above embodiment for darkly lighted environments. To accomplish this result it is necessary that the reflective layers 68,70 be transmissive in order to pass the light from the light sources 72,74. In particular, a top light source 72 is coupled to the top reflective layer 68 and a bottom light source 74 is coupled to the bottom reflective layer 70, wherein the reflective layers 68,70 are sandwiched between the panel and their associated light sources 72,74. As the reflective layers are actually transmissive, the light sources provide backlighting through their associated reflective layer and into the panel.

A transreflector reflects ambient light and transmits light from the light source. However, the reflection efficiency is necessarily reduced by adding transmissive properties. Similarly, transmission properties are reduced by increased reflection properties. For example, a transreflector can transmit fifty percent of the light from the light source and reflect

4

fifty percent of ambient light such that the proportion of viewable light in either mode is reduced. Therefore, it is preferred that the reflective layers 68,70 are holographic elements optically coupled to the panel 50 such light traversing the top portion 62 of the panel 50 from the first side 60 to the reflective layer 68 on the second side 64 is reflected back towards the first side 60 and light traversing the bottom portion 66 of the panel 50 from the second side 64 to the reflective layer 70 on the first side 60 is reflected back towards the second side 64.

In particular, the reflective holographic element redirects the light in constricted reflection patterns about a preferential axis that constitutes a preferred viewing angle, thereby increasing the amount of reflected light, as is known in the art. In addition, the holographic element can be electrically switched by the driving circuit to further enhance either a reflective or transmissive mode of operation. Moreover, an additional material layer can be interposed between the light sources and their associated reflectors such that the material layer is chosen to pass only that spectrum of frequencies generated by the light source, thereby providing color optimization for the display. Suitable holographic materials and applications thereof are described in U.S. Pat. No. 5,663,816 to Chen et al. which is hereby incorporated by reference.

In a preferred embodiment, a light barrier 80 is disposed around the panel 50 and between the panel 50 and the housing 14 to optically separate the top and bottom portions 62,66 of the display 12. Although this is not a requirement, the light barrier serves to absorb stray light within the LCD panel and between the top and bottom portions of the panel. Also, it is preferred to have the light barrier installed between the display and the housing to further isolate from reflected light and to provide additional mechanical strength in the mounting of the display in the housing.

In operation, a processor 82 is coupled to the driver circuit 52, wherein the processor 82 directs the display 12 through the driver circuit 52 to provide user interface information for operating the communication device 10. Preferably, the processor is shared with, and provides radio telephones operation for, the communication device 10. The processor 82 drives the bottom portion 66 of the display 12 to provide alphanumeric information including at least one of the group comprising a date, a time, and a caller ID telephone number through the second viewport 18 of the housing 14. Preferably, the processor 82 drives the bottom portion 66 of the display to display the alphanumeric information in one of two orientations according to user preference. For example, as represented in FIG. 3, a caller ID number can be displayed with the number read right-side-up in the display (i.e., the top of the digits of the number are closest to a hinge of the communication device) or the caller ID number can be displayed with the bottom of the digits of the number closest to a hinge of the communication device. With the former, the caller ID number is most easily read when the communication device is hand-held. With the latter, the caller ID number can be quickly viewed upside-down when the communication device is located in a belt or holster on the user. The processor 82 drives the top portion 62 of the display 12 to provide graphical or alphanumeric information representing operating conditions of the communication device 10.

In all of the aforementioned embodiments it is preferred that the structures as shown in FIG. 5, with the exception of the driving circuit 52 and processor 82, are laminated onto the panel 50 to form an integrated structure.

The present invention provides numerous advantages. Firstly, the dual-sided display is thinner than using two back-to-back displays since only one LCD panel is needed which saves size, weight and cost. Secondly, only a single driving circuit is needed which saves power, size, weight

5

and cost. Thirdly, differently sized displays can be utilized, whereas with back-to-back displays some type of light barrier must be interposed to prevent light from the light sources from bleeding into either display.

It is to be understood that the phrasology or terminology employed herein is for the purpose of description and not of limitation. Accordingly, the invention is intended to embrace all such alternatives, modifications, equivalents and variations as fall within the broad scope of the appended claims.

What is claimed is:

1. A communication device with a dual-sided liquid crystal display, comprising:

a housing for holding the display, the housing having a first side with a first viewport and a second side with a second viewport;

a liquid crystal panel with an associated driver circuit, the panel having a first side for viewing a top portion of the display from the first viewport and a second side for viewing a bottom portion of the display from the second viewport;

a top reflective layer disposed on the top portion of the panel on the second side of the panel;

a bottom reflective layer disposed on the bottom portion of the panel on the first side of the panel; and

a processor coupled to the driver circuit, wherein the processor directs the display through the driver circuit to provide user interface information for operating the communication device, and wherein

the reflective layers are holographic elements optically coupled to the panel such that light traversing the top portion of the panel from the first side to the reflective layer on the second side is reflected back towards the first side and light traversing the bottom portion of the panel from the second side to the reflective layer on the first side is reflected back towards the second side.

2. The communication device of claim 1, wherein the reflective layers are transfective, and further comprising a top light source coupled to the top reflective layer and a bottom light source coupled to the bottom reflective layer, wherein the reflective layers are sandwiched between the panel and their associated light sources, the light sources provide backlighting through their associated reflective layer and into the panel.

3. The communication device of claim 2, wherein light sources are electroluminescent panels, and wherein the reflective layers and electroluminescent panels provide top and bottom display regions sized to substantially fill their associated viewing ports.

4. The communication device of claim 1, further comprising a light barrier disposed around the panel and between the panel and the housing to optically separate the top and bottom portions of the display.

5. The communication device of claim 4, wherein the light barrier serves to absorb stray light within the panel and between the top and bottom portions of the panel.

6. The communication device of claim 1, wherein the viewports of the housing are covered with substantially transparent lenses.

7. The communication device of claim 1, wherein the housing comprises a movable portion of the communication device wherein the second viewport is visible when the housing is closed against the communication device covering the first viewport.

8. The communication device of claim 1, wherein the processor drives the bottom portion of the display to provide alphanumeric information including at least one of the group comprising a date, a time, and a caller ID telephone number through the second viewport of the housing.

6

9. The communication device of claim 8, wherein the processor drives the bottom portion of the display to display the alphanumeric information in one of two orientations according to user preference.

10. A communication device with a dual-sided liquid crystal display, comprising:

a housing for holding the display, the housing having a first side with a first viewport and a second side with a second viewport;

a liquid crystal panel with an associated driver circuit, the panel having a first side for viewing a top portion of the display from the first viewport and a second side for viewing a bottom portion of the display from the second viewport;

a top transfective layer disposed on the top portion of the panel on the to second side of the panel;

a top electroluminescent panel coupled to the top transfective layer such that the top transfective layer is sandwiched between the panel and the top electroluminescent panel;

a bottom transfective layer disposed on the bottom portion of the panel on the first side of the panel;

a bottom electroluminescent panel coupled to the bottom transfective layer such that the bottom transfective layer is sandwiched between the panel and the bottom electroluminescent panel; and

a processor coupled to the driver circuit, wherein the processor directs the display through the driver circuit to provide user interface information for operating the communication device, and wherein

the top and bottom transfective layers are holographic elements optically coupled to the panel such that light traversing the top portion of the panel from the first side to the transfective layer on the second side is reflected back towards the first side and light traversing the bottom portion of the panel from the second side to the transfective layer on the first side is reflected back towards the second side.

11. The communication device of claim 10, wherein the top and bottom transfective layers and the top and bottom electroluminescent panels provide top and bottom display regions sized to substantially fill their associated viewing ports, in their respective display regions the electroluminescent panels provide backlighting through the associated transfective layer and into the panel.

12. The communication device of claim 10, further comprising a light barrier disposed around the panel and between the panel and the housing to optically separate the top and bottom portions of the display, the light barrier serves to absorb stray light within the panel and between the top and bottom portions of the panel.

13. The communication device of claim 10, wherein the viewports of the housing are covered with substantially transparent lenses.

14. The communication device of claim 10, wherein the processor drives the bottom portion of the display to provide at least one of the group comprising a date, a time, and a caller ID telephone number through the second viewport of the housing.

15. The communication device of claim 10, wherein the housing comprises a movable portion of the communication device wherein the second viewport is visible when the housing is closed against the communication device covering the first viewport.

* * * * *



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United States Patent [19]
Jahagirdar et al.

[11] **Patent Number:** **6,125,286**
[45] **Date of Patent:** ***Sep. 26, 2000**

[54] **COMMUNICATION DEVICE HAVING
MULTIPLE DISPLAYS AND METHOD OF
OPERATING THE SAME**

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[73] **Assignee:** Motorola, Inc., Schaumburg, Ill.

[*] **Notice:** This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Primary Examiner—Doris H. To

Attorney, Agent, or Firm—John Oskorep; Brian Mancini

[57] **ABSTRACT**

A portable communication device (102) includes a housing (105), a first display area (130), and a second display area (132). The first display area (130) is outwardly directed from a side (122) of the housing (105), and the second display area (132) is outwardly directed from a front (120) of the housing (105). The housing (105) may include a housing portion (114) movable to an open position and a closed position, where the second display area (132) is covered by the housing portion (114) when positioned in one of the first and the second positions.

[21] **Appl. No.:** 08/869,543

[22] **Filed:** Jun. 5, 1997

[51] **Int. Cl.⁷** H04B 1/38

[52] **U.S. Cl.** 455/566; 455/90; 379/433

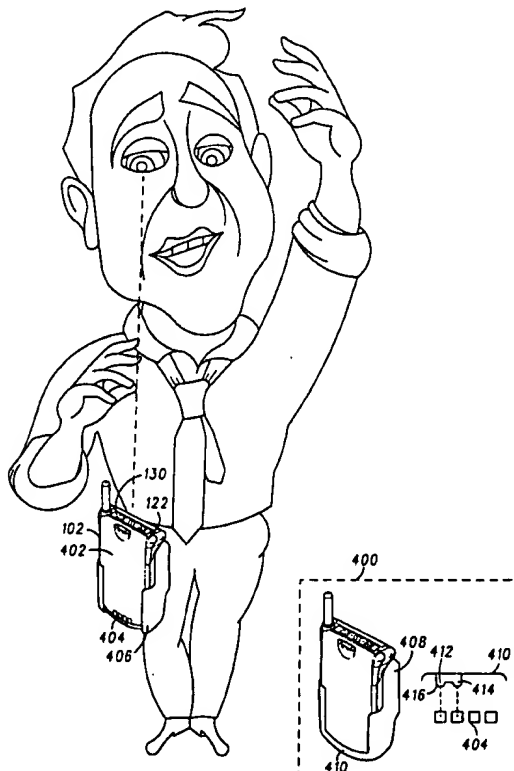
[58] **Field of Search** 455/575, 90, 566,
455/550, 38.4, 351, FOR 121; 345/169-10,
245; 379/428, 433, 455

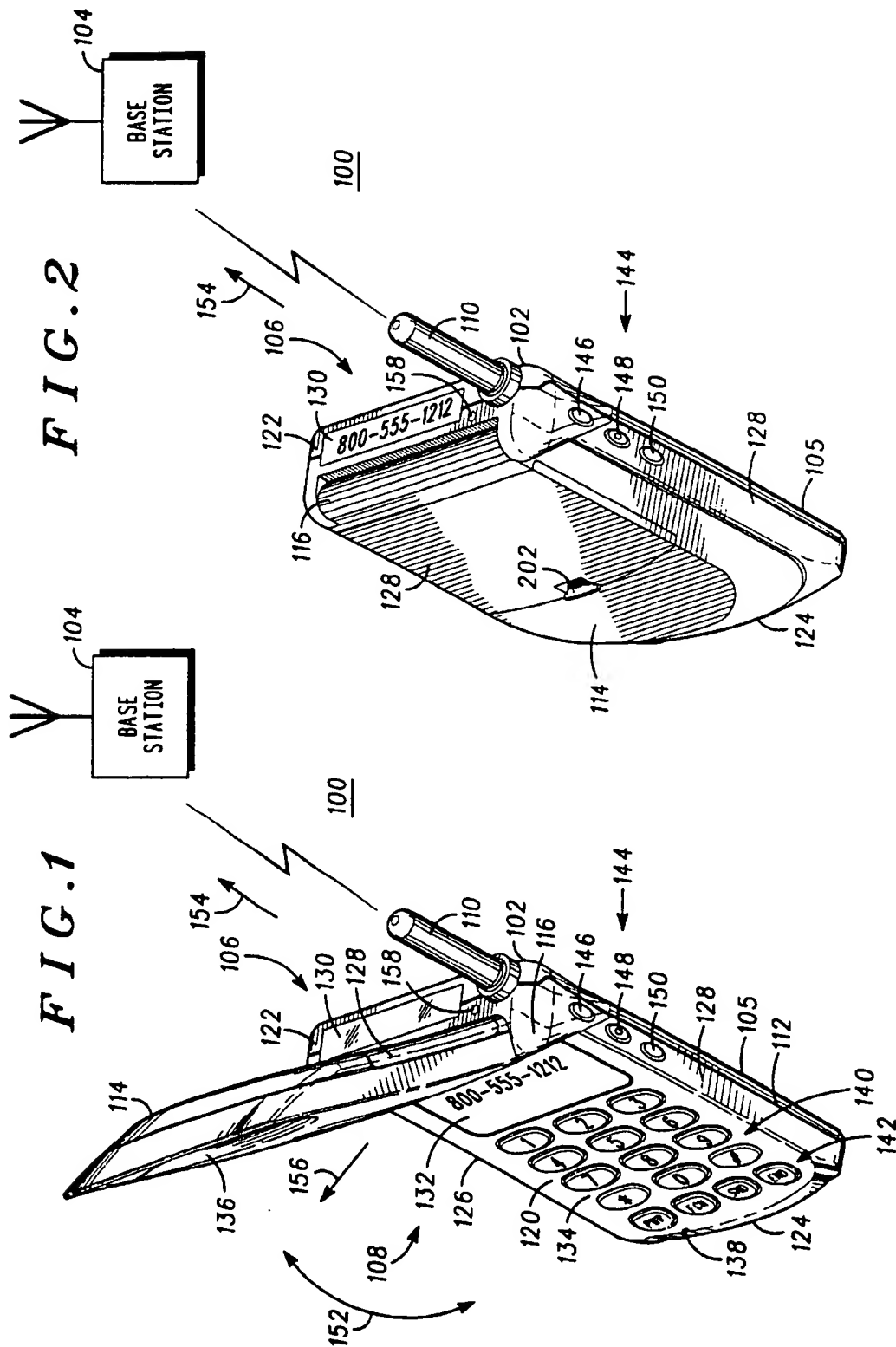
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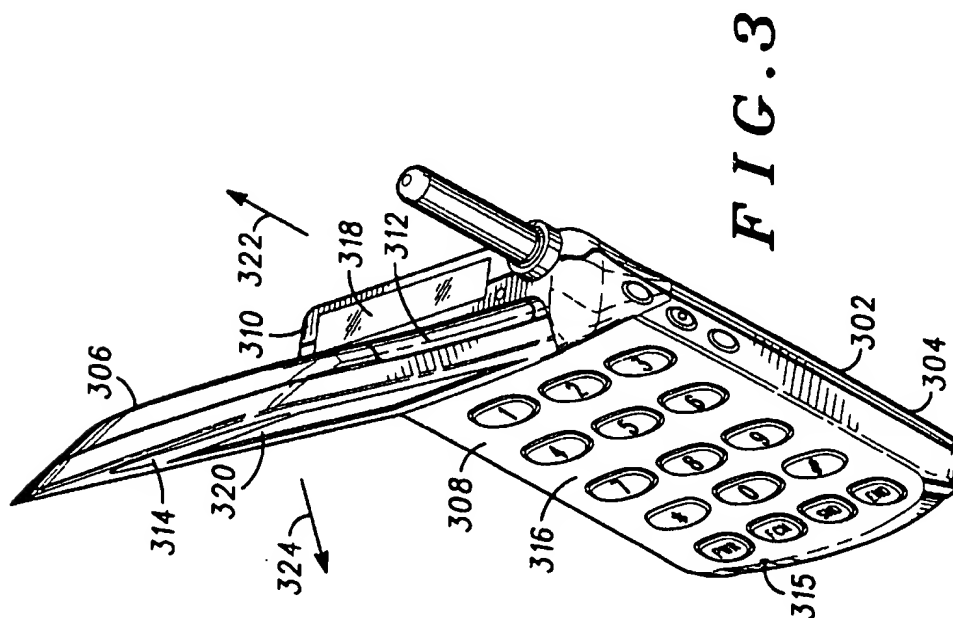
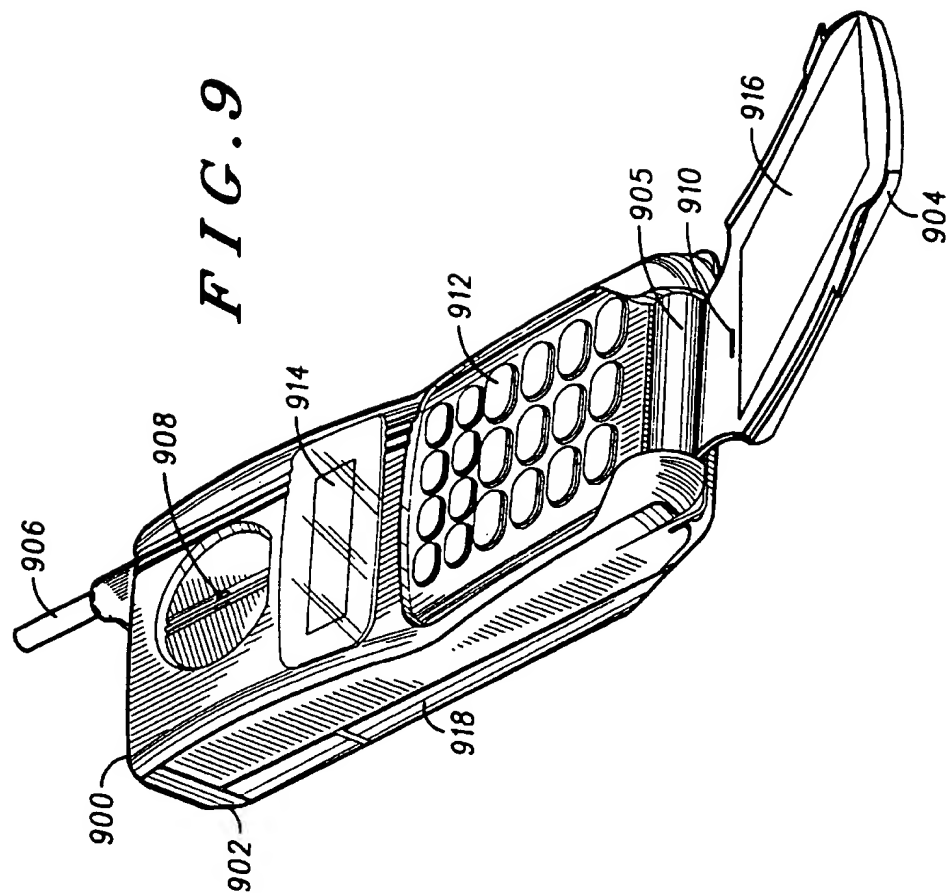
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13 Claims, 6 Drawing Sheets







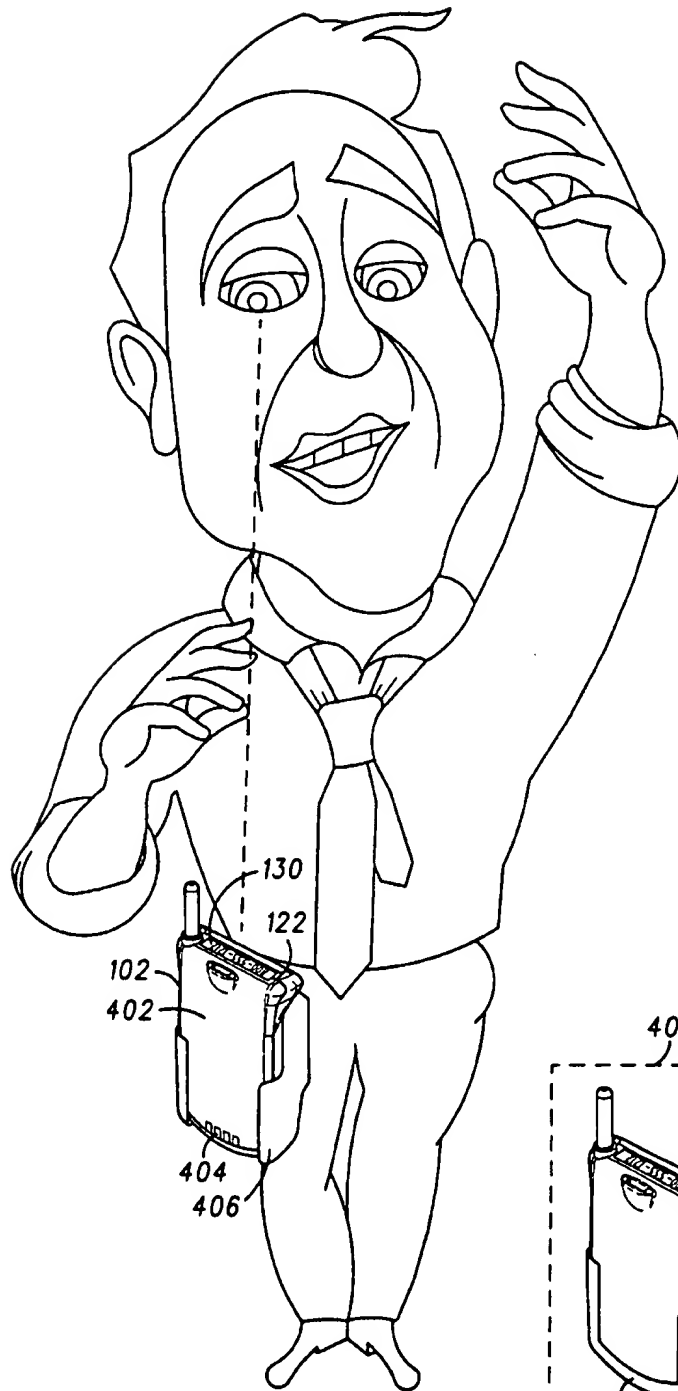
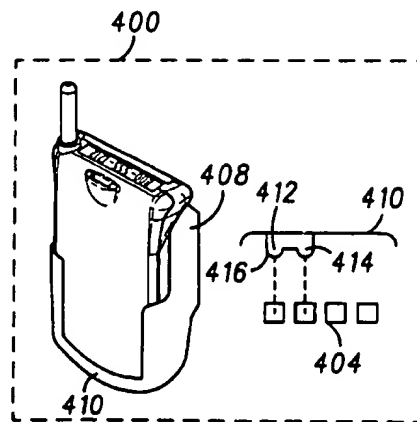


FIG. 4



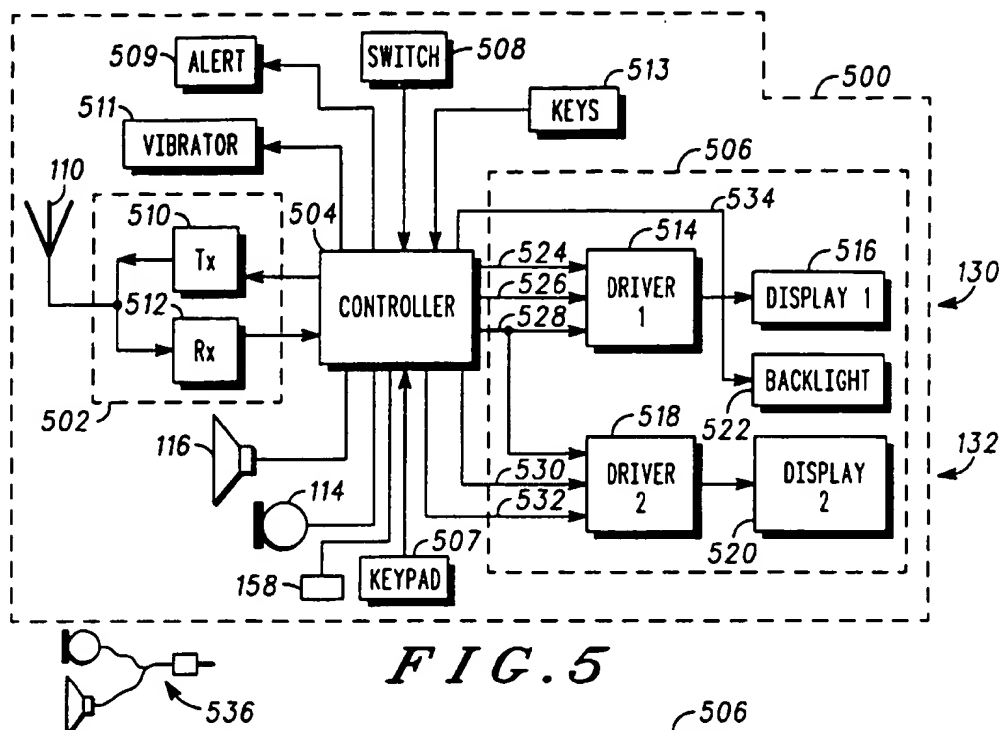


FIG. 5

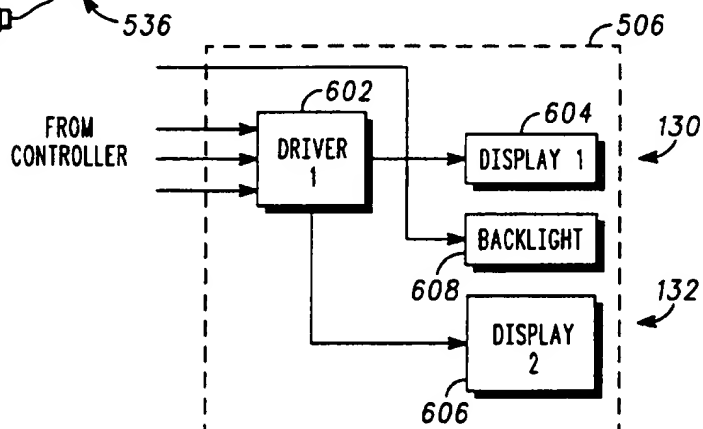


FIG. 6

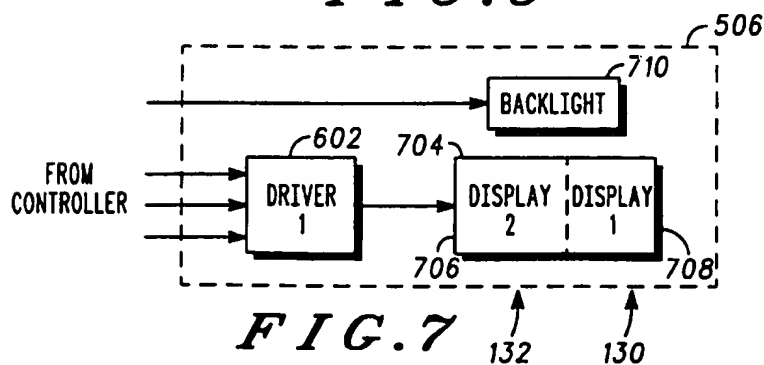


FIG. 7

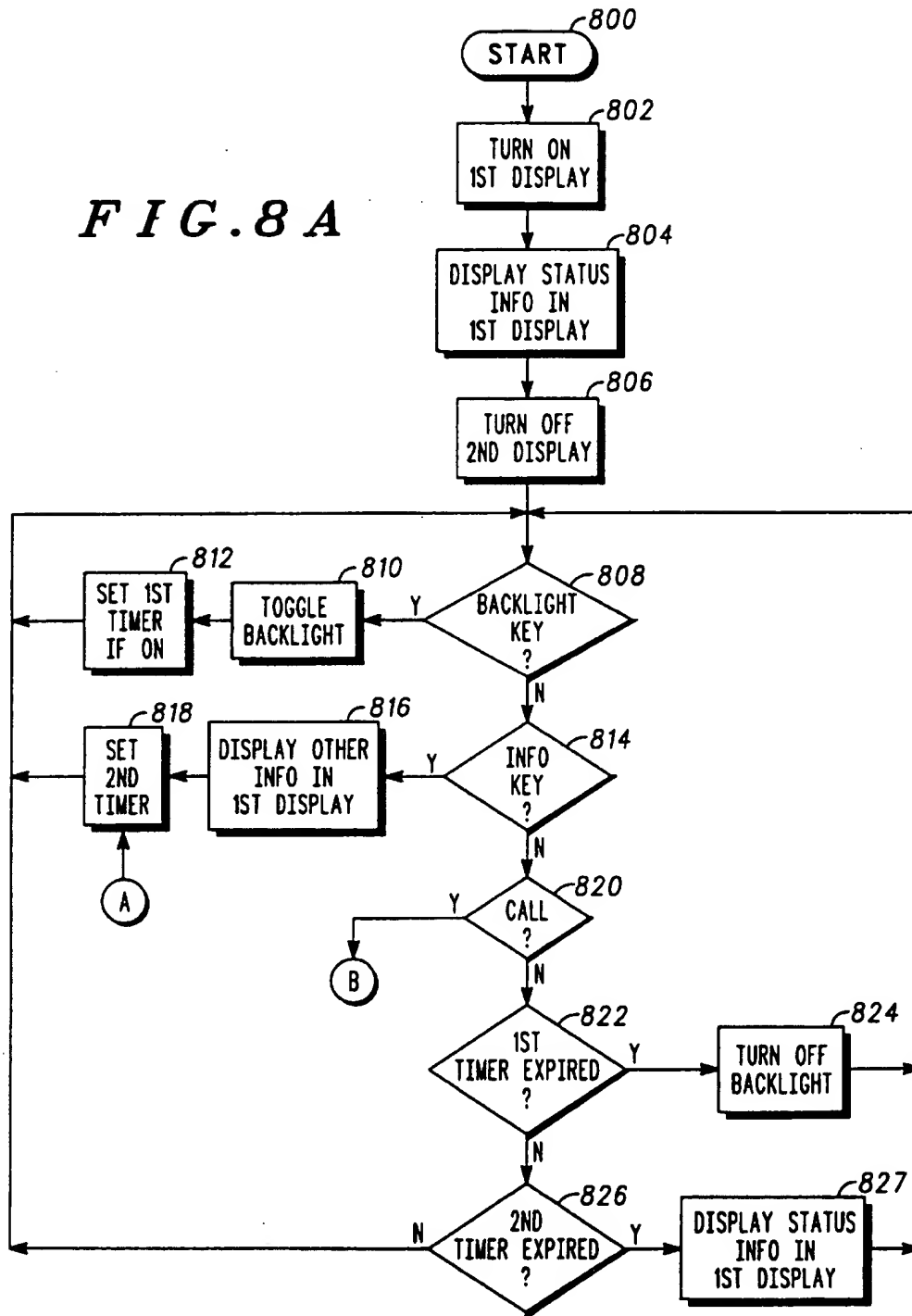
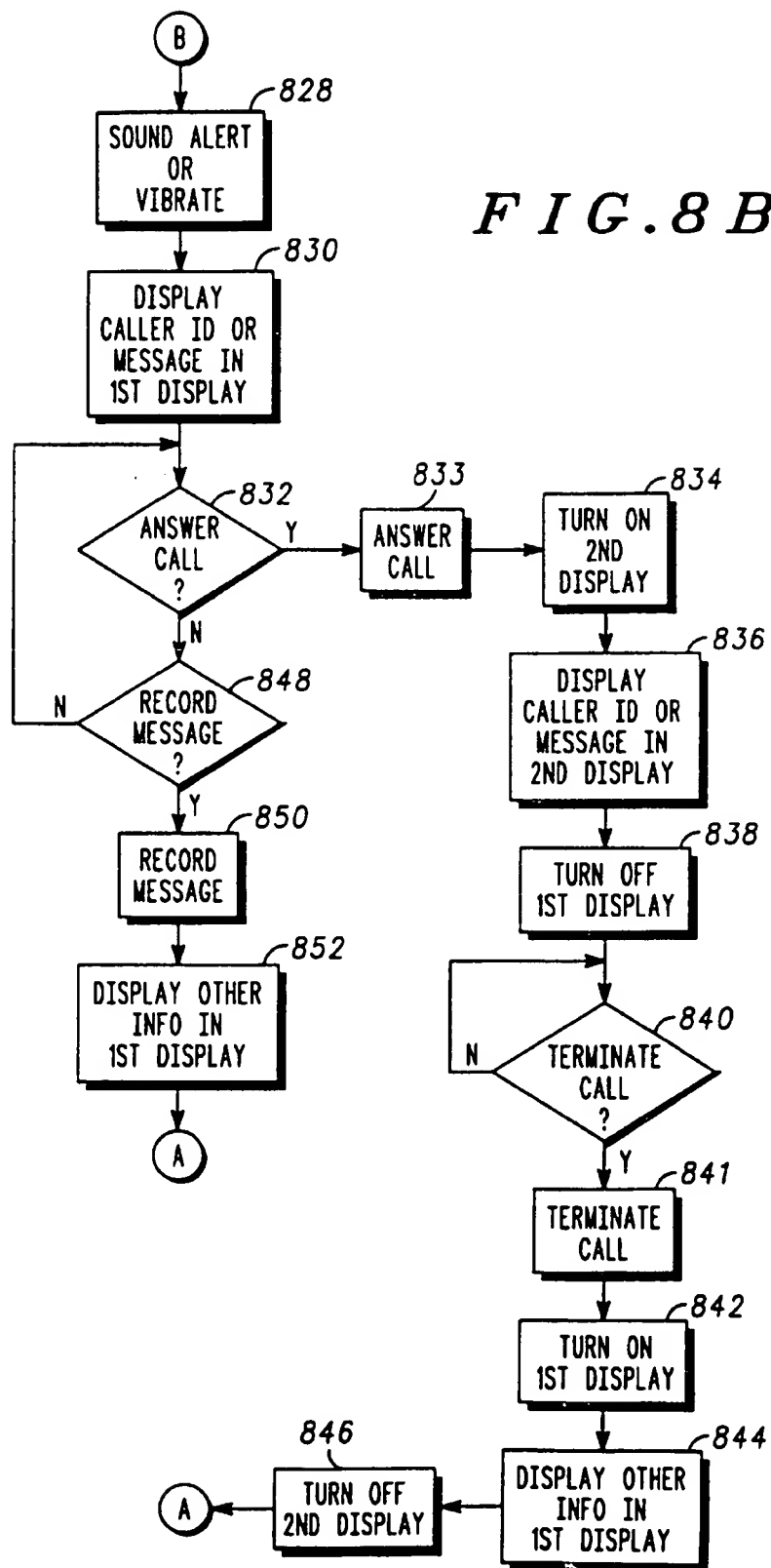
FIG. 8A

FIG. 8B



COMMUNICATION DEVICE HAVING MULTIPLE DISPLAYS AND METHOD OF OPERATING THE SAME

FIELD OF THE INVENTION

The present invention relates generally to communication devices having multiple displays, and more particularly to portable radio communication devices having multiple displays.

BACKGROUND OF THE INVENTION

Many portable communication devices, such as cellular telephones, include housings defining relatively large front and rear surfaces with thin sides. Such a device may be thin enough to fit within a pocket of clothing or to carry on a belt or a holster. Typically, the front surface of the device has a user interface which includes one or more components such as a keypad or a display. When the device is carried as described above, the user interface may not be very accommodating to a user. For example, when such a device is carried on a belt of a user, the user interface is completely or partially obstructed from the user's view.

In addition, some devices have flaps which cover the user interface for protection against various elements such as dirt or rain, or for other reasons such as for protection against inadvertent actuations at the keypad. Although highly beneficial, such flaps may similarly or further inhibit viewing of the user interface.

Accordingly, what is needed is a communication device having a user interface that is more accommodating to a user, and additionally one that does not substantially increase a power consumption or cost of the communication device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of a mobile station having a first display area and a second display area.

FIG. 2 is an illustration of the mobile station of FIG. 1.

FIG. 3 is an illustration of an alternate embodiment of a mobile station.

FIG. 4 is an illustration of the mobile station being worn in a holster by a user.

FIG. 5 is a schematic block diagram of electrical circuitry of the mobile station.

FIG. 6 is a schematic block diagram of a first alternate embodiment of display components of the electrical circuitry.

FIG. 7 is a schematic block diagram of a second alternate embodiment of the display components.

FIG. 8A is a first part of a flowchart describing the operation of the mobile station.

FIG. 8B is a second part of the flowchart describing the operation of the mobile station.

FIG. 9 is an illustration of another alternate embodiment of a mobile station.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

According to the present invention, a portable communication device comprises a housing, a first display area, and a second display area. The first display area is outwardly directed from a side of the housing and the second display area is outwardly directed from a side of the housing. The

housing may include a housing portion movable to an open position and a closed position, where the second display area is covered by the housing portion in one of the first and the second positions.

FIG. 1 shows a communication system 100 comprising a mobile station 102 and a base station 104. Mobile station 102 and base station 104 communicate via radio frequency (RF) signals to provide wireless communications and features such as paging, telephone, and short messaging features. Preferably, communication system 100 provides cellular telephone communications and additional communication services.

Mobile station 102 comprises a housing 105, a user interface 106, and a user interface 108. To transmit and receive the RF signals to and from base station 104, mobile station 102 also includes an antenna 110. Mobile station 102 may also include an accessory jack 158.

Housing 105 includes a housing portion 112 and a housing portion 114. Housing portion 114 is movable between a first position and a second position. The first position may be referred to as an open position, such as that shown in FIG. 1, and the second position may be referred to as a closed position, such as that shown in FIG. 2. Housing portion 114 may be generally referred to as a movable element or a flap. Also, housing portions 112 and 114 may be generally referred to as lower and upper housing portions, respectively. Housing 105 is made from a durable material, preferably plastic.

In the embodiment shown, housing portion 114 is coupled to housing portion 112 via a hinge 116 providing a rotation for housing portion 114 to and from the first and the second positions as indicated by an arrow 152. Other suitable mechanisms for providing movement are known in the art and may be used accordingly.

Housing portion 112 defines a surface 120 (forming a front of housing 105), a surface 122 (forming a top side of housing 105), a surface 124 (forming a bottom side of housing 105), a surface 126 (forming a left side of housing 105), and a surface 128 (forming a right side of housing 105). Each of surfaces 122, 124, 126, and 128 meet with and are adjacent and generally perpendicular to surface 120. Widths of surfaces 122, 124, 126, and 128 are generally much smaller than a width of surface 120. For example, the width of surface 120 may be about four times that of each width of surfaces 122, 124, 126, and 128. Preferably, the width of surface 120 is about 5 centimeters and each width of surfaces 122, 124, 126, and 128 is about 1.25 centimeters. Housing portion 114 is sized and shaped similarly to that of housing portion 112 and includes similarly defined surfaces.

Sized and constructed as described above, mobile station 102 may be described as being "wearable," that is, it is sized to fit into a pocket or attach to clothing using a holster or a belt clip as will be shown and described further below in relation to FIG. 4.

User interface 106 includes a display area 130 for displaying information. User interface 106 may be referred to as a pager user interface. In the embodiment shown, display area 130 is carried on and outwardly directed from surface 122. Display area 130 presents visual information directed in a direction indicated by an arrow 154 of FIGS. 1 and 2. Display area 130 may include a display window and display elements discussed in more detail below.

User interface 108 includes a display area 132 for displaying information, a keypad 134, a speaker 136 disposed in housing portion 114, and a microphone 138 disposed in housing portion 112. User interface 108 may be referred to

as a telephone user interface. Display area 132 is carried on and outwardly directed from surface 120. Display area 132 presents visual information in a direction indicated generally by an arrow 156 of FIG. 1. Display area 132 may include a display window and display elements discussed in more detail below.

When a user of mobile station 102 views display area 132 and any visual information displayed therein, display area 130 and any visual information therein is obstructed from view because of the particular orientations of display areas 130 and 132 on housing 105, and/or because of the position of housing portion 114 relative to housing portion 112. Likewise, when the user views display area 130 and any visual information therein, display area 132 and any visual information therein is similarly obstructed from view for the same or similar reasons.

Keypad 134 is carried on surface 120 and may include a plurality of telephone keys 140 and a plurality of function keys 142. The plurality of telephone keys 140 typically includes conventional telephone keys (0-9, *, and #) provided for initiating telephone calls. The plurality of function keys 142 typically includes conventional cellular telephone function keys, such as an on/off key, a function key, a send key, and an end key. Keypad 134 is operable for use when housing portion 114 is positioned in the open position. Display area 132 typically displays alphanumeric characters, such as telephone digits, corresponding to actuations at keypad 134. In the embodiment shown, user interface 108 is covered when housing portion 114 is positioned in the closed position. Mobile station 102 also includes a plurality of keys 144 disposed on surface 128. Here, the plurality of keys 144 includes a key 146, a key 148, and a key 150.

Mobile station 102 also includes a removable battery 128, carried on housing portion 114, provided for powering electrical circuitry, described below, of mobile station 102. Removable battery 128 includes battery contacts (not visible) which electrically couple to the electrical circuitry through hinge 116 via electrical conductors. Removable battery 128 includes a latching mechanism 202 (FIG. 2) which helps keep removable battery 128 attached to housing portion 114.

FIG. 3 shows an alternate embodiment of a mobile station, in particular a mobile station 302. Mobile station 302 includes a housing portion 304, a housing portion 306, a speaker 314 disposed in housing portion 306, a removable battery 312 carried on housing portion 306, a microphone 315 disposed in housing portion 304, and a keypad 316 carried on housing portion 304. Mobile station 302 also includes a display area 318 and a display area 320. Display area 318 is outwardly directed from a surface 310 of housing portion 304, and display area 320 is outwardly directed from a surface of housing portion 306.

FIG. 4 shows a user wearing mobile station 102 in a holster 406. Here, the size of mobile station 102 is greatly exaggerated for illustration purposes only. Mobile station 102 is inserted within a holding portion of holster 406, and holster 406 is attached to an item of clothing of the user via a belt clip (not visible) of holster 406.

FIG. 5 shows a schematic block diagram of electrical circuitry 500 of mobile station 102. Electrical circuitry 500 includes a transceiver 502, a controller 504, display components 506, a keypad circuit 507, a switch 508, an alert 509, a vibrator 511, a key circuit 513, microphone 114, and speaker 116. Preferably, most of electrical circuitry 500, including transceiver 502 and controller 504 which consume a large portion of physical space, is disposed in housing portion 112 on a printed circuit board (PCB).

Transceiver 502 is coupled to antenna 110 and includes a transmitter 510 and a receiver 512. Receiver 512 receives RF signals through antenna 110 and demodulates the RF signals. Controller 504 is coupled to and receives the demodulated information from receiver 512. Such information includes control information and may include voice information which is processed and sent to speaker 116. Controller 504 is coupled to transmitter 510 and sends information thereto for transmission. Such information includes control information and may include voice information received from microphone 114. Microphone 114 and speaker 116 are coupled to controller 504 through audio circuitry (not shown). A speaker and mic accessory 536, which includes an ear speaker and a microphone coupled to a plug via a cord, can insert into accessory jack 158 and couple to controller 504.

Keypad circuit 507 provides signals to controller 504 in response to actuations of keys at keypad 134 (FIG. 1). Similarly, key circuit 513 provides signals to controller 1 in response to actuations of the plurality of keys 144 (FIG. 1). Switch 508 provides signals to controller 504 in response to movements of housing portion 114 to and from the first and the second positions. Preferably, switch 508 comprises a magnetic switch. In response to receiving a call from a remote unit, controller 504 controls alert 509 to sound an audible alert signal or controls vibrator 511 to vibrate.

In the embodiment shown in FIG. 5, display components 506 include a driver 514, a display element 516, a driver 518, a display element 520, and a backlight 522. Controller 504 generates display data to be displayed at display areas 130 and 132. Controller 504 controls power to driver 514 and display element 516 through a line 524. Similarly, controller 504 controls power to driver 518 and display element 520 through a line 530. Controller 504 selects one of drivers 514 and 518 to receive display data through a line 526 (for driver 514) and a line 532 (for driver 518), and sends the display data via a data bus 528 coupled to both of drivers 514 and 518. Controller 504 controls power to backlight 522 through a line 534.

Display elements 516 and 520 provide visual information in display areas 130 and 132, respectively, for a user of mobile station 102. Each of display elements 516 and 520 may comprise any suitable display or displays such as a light emitting diode (LED) display or a liquid crystal display (LCD). In addition to having illuminating segments or pixels, such displays may include illuminating icons. Typically, display elements 516 and 520 are substantially planar and rectangular in shape and thus, for the embodiment shown in FIGS. 1 and 2, are positioned substantially perpendicular to one another in housing portion 112.

Preferably, element 516 is a single line LCD and element 520 is a multiple line LCD. Also preferably, display element 520 has a resolution greater than a resolution of display element 516. If both of display elements 516 and 520 are LCDs, backlight 522 is preferably designed and positioned such that backlighting is provided for both of display elements 516 and 520. Also preferably, display components 506 are mounted to a secondary printed circuit board (PCB) that is different from a main PCB holding a remaining portion of electrical circuitry 500 (such as transceiver 502 and controller 504). Here, the secondary PCB is attached and coupled to the main PCB via a flex connector.

FIG. 6 shows a first alternate embodiment of display components 506. Here, display components 506 include a driver 602, a display element 604, a display element 606, and a backlight 608. Display element 604 provides visual

information in display area 130, and display element 606 provides visual information in display area 132. Display elements 604 and 606 share driver 602. Preferably, driver 602 and display element 606 are mounted on a secondary PCB and coupled to the main PCB via a first flex connector, and display element 604 is coupled and attached to the secondary PCB via a second flex connector. Since the second flex connector is flexible, display element 604 and display element 606 may be appropriately configured and positioned within housing portion 112.

FIG. 7 shows a second alternate embodiment of display components 506. Here, display components 506 include a driver 702, a flexible display element 704, and a backlight 710. Flexible display element 704 is indeed flexible, and comprises a display portion 706 and a display portion 708. Display portion 706 provides information for display area 130, and a display portion 708 provides information for display area 132. As can be understood from the configuration of display areas 130 and 132 shown in FIG. 1, flexible display element 704 is bent or curved within housing portion 112 such that display portion 706 is substantially perpendicular relative to display portion 708.

FIGS. 8A and 8B show a flowchart describing a method of operating electrical circuitry 500 of mobile station 102. The method described here utilizes display components 506 shown and described in relation to FIG. 5. Mobile station 102 is in a standby mode of operation. At start block 800, housing portion 114 is positioned from the open position to the closed position. Controller 504 enables power to driver 514 and display element 516 through line 524 (step 802). Controller 504 enables driver 514 for data communication via line 526, and sends display data thereto. Driver 514 sends data to display element 516 for displaying visual information, preferably status information, in display area 130 (step 804). If power was previously enabled for driver 518 and display element 520, controller 504 disables power thereto (step 806).

Here, the status information may include date and time information, battery status information such as a battery level indication and/or a low battery warning indication, communication status information such as an "in use" indication and/or a roam indication, or any combinations of the above. Alternatively, the status information may include little or no information, where display area 130 is cleared.

Controller 504 reads key circuitry 513 to detect actuations of the plurality of keys 144. If controller 504 detects an actuation of key 146 (step 808), controller 504 toggles the on/off state of backlight 522 (step 810). That is, controller 504 turns on backlight 522 if backlight 522 is off, and turns off backlight 522 if backlight 522 is on. If backlight 522 is turned on from step 810, controller 504 sets a timer (step 812) to turn off backlight 522 after an expiration of a predetermined time period (see steps 822 and 824).

If controller 504 detects an actuation of key 150 (step 814), controller 504 sends display data to driver 514, which sends display data to display element 516. For displaying new visual information in display area 130. The new visual information includes information different from or in addition to the status information, and may include date and time information, battery status information such as a battery level indication and/or a low battery warning indication, communication status information such as an "in use" indication and/or a roam indication, or any combinations of the above. Controller 504 sets a timer related to the new display information (step 818).

If controller 504 detects an incoming call (step 820), the method continues in FIG. 8B. Controller 504 controls alert

509 to sound an audible alert signal (step 828). Alternatively at step 828, controller 504 may control vibrator 511 to vibrate. Receiver 512 demodulates the received RF signals and generates data signals such as caller ID or short messaging data. Controller 504 receives such data, generates display data and sends it to driver 514 via line 528 for displaying visual information in display area 130 corresponding to such data. For example, display area 130 may display caller ID data in a manner similar to that shown in FIG. 2. When a large amount of information is to be displayed, controller 504 may control driver 514 such that display element 516 scrolls the information (from left to right, for example) or periodically flashes new information.

Controller 504 detects a control signal from switch 508 when housing portion 114 is moved from the closed position to the open position (step 832), which here signifies an intention to answer the call. In response to such detection, mobile station 102 answers the call (step 833). Controller 504 enables power to driver 518 and display element 520 corresponding to display area 132 via line 530 (step 834). Controller 504 enables driver 518 for data communication via line 532, and sends the display data to driver 518 via data bus 528. Driver 518 sends data to display element 520, and visual information is displayed in display area 132 (step 836). Controller 504 powers off driver 514 and display element 516 via line 524, thereby turning off display area 130 (step 838).

Preferably, the visual information corresponding to step 836 includes the caller ID or short messaging data obtained upon receipt of the call. For example, the visual information may include the caller ID data and may be displayed as shown in FIG. 1. Since display area 132 is preferably larger or is capable of displaying more visual information than display area 130, display area 132 may display the visual information in its entirety, whereas display area 130 may have had to display the visual information by scrolling or other methods known in the art.

At step 832, when speaker and mic accessory 536 is inserted in accessory jack 158, an actuation of one of the plurality of keys 144 may answer the call without having to move housing portion 114 to the open position (and also without having to remove mobile station 102 from a holster). After the call is completed, an actuation of one of the plurality of keys 144 may terminate the call.

If the call is a two-way call, such as a two-way telephone or telephone-like call, the user of mobile station 102 uses microphone 114 and speaker 116 for voice communication. Controller 504 detects a control signal from switch 508 when housing portion 114 is moved from the open position to the closed position (step 840). In response to such detection, controller 504 performs tasks to terminate the call (step 841). In addition, controller 504 powers on driver 514 and display element 516 via line 524 (step 842). Controller 504 enables driver 514 for data communication via line 526 and sends display data thereto via data bus 528. Driver 514 sends data to display element 516 to display visual information corresponding to such data in display area 130 (step 844). Controller 504 disables power from driver 518 and display element 520, thereby turning off display area 132 (step 846). The method continues back at step 818 of FIG. 8A.

The visual information corresponding to step 844 may be the same as that described in relation to step 804 (time, date, etc.). Preferably, the visual information corresponding to step 844 includes information regarding the two-way call, such as the duration of the call, "units" of time used for the

call, the amount of money charged for the call, or any combination of the above. Such information may be real or approximated; base station 104 may send this information to mobile station 102 and/or mobile station 102 may be equipped with a real time clock (not shown). Also preferably, if such preferred information is displayed, display area 516 displays similar or the same visual information as that described in relation to step 804 (time, date, etc.) after an expiration of a predetermined time period (see steps 826 and 827 of FIG. 8A) or after an actuation of one of the plurality of keys 144.

At step 832, housing portion 114 may not be opened after a detection of the incoming call, and thus controller 504 may not detect the control signal from switch 508. Controller 504 may detect an actuation of one of the plurality of keys 144 via key circuit 513 (step 848). In response thereto, controller 504 initiates an immediate forwarding of the incoming call to voice mail or to an answering device with memory, where a synthesized message is played to a caller and a voice message may be recorded (step 850). Other information may then be displayed in display area 130 (step 852), and the method continues back at step 818 of FIG. 8A.

At step 848, none of the plurality of keys 144 may be actuated after a detection of the incoming call, and thus controller 504 may not detect any signals from key circuit 513. Controller 504 continues to monitor detection of signals from switch 508 and key circuit 513 in steps 832 and 848.

The option described in relation to steps 848 and 850 may be preferred when it is not desired to answer the incoming call (perhaps upon viewing the visual information in display area 130) and to hear or feel signals from alert 509 or vibrator 511 for a long duration of time.

Mobile station 102 may operate display areas 130 and 132 in response to other input signals. For example, FIG. 4 shows a view 400 of a holster 408 having a holster surface 410. Mobile station 102 has electrical contacts 404 (also FIG. 4) on a surface 402 (forming a rear of housing 105) thereof. On an inside of holster 410, holster surface 408 has a conductive element 412 having a contact 412 and a contact 414. When mobile station 102 is outside of holster 408, display area 130 is powered off and display area 132 is powered on (if exposed). When mobile station 102 is inserted into holster 408, two of electrical contacts 404 are shorted from conductive element 412 and, in response to this, display area 130 is powered on by controller 504 while display area 130 is powered off.

FIG. 9 shows another alternate embodiment of a mobile station, in particular a mobile station 900. Mobile station 900 includes a housing portion 902 and a housing portion 904 coupled together via a hinge 905, where housing portion 904 is movable from open and closed positions. In FIG. 9, housing portion 904 is shown in the open position. Mobile station 902 also includes a retractable antenna 906 outwardly extendible from housing portion 902, a speaker 908 disposed in and outwardly directed from housing portion 902, a microphone 910 disposed in and outwardly directed from housing portion 904, and a keypad 912 carried on housing portion 902.

Mobile station 902 includes a display area 914 outwardly directed from a front of housing portion 902, and a display area 916 outwardly directed from housing portion 904. When housing portion 904 is moved to the closed position, display area 914 is obstructed from view, whereas display area 916 is available for viewing. Display area 914 preferably includes a single line LED display, and display area 916

preferably includes a large graphics LCD. Mobile station 902 operates similarly or in the same way as mobile station 102 as described in relation to the flowchart of FIGS. 8A and 8B.

While particular embodiments of the present invention have been shown and described, modifications may be made. For example, display area 130 of FIG. 1 may be placed along any suitable side of housing portions 112 and 114 for displaying visual information to a user. It is therefore intended in the appended claims to cover all such changes and modifications which fall within the true spirit and scope of the invention.

What is claimed is:

1. A portable electronic device configured to be held in a holster having electrical contacts to connect to the device located therewithin, comprising:

a housing, said housing including a movable element movable between an open position and a closed position;

a radio transceiver, said radio transceiver disposed in said housing, said transceiver configured to detect a call from a calling unit and receive information corresponding thereto;

a first user interface, said first user interface including a first display area, said first display area viewable when said movable element is in the closed position;

a second user interface, said second user interface including a second display area and a plurality of telephone keys, said second display area and said plurality of telephone keys viewable when said movable element is in the open position, said second display area and said plurality of telephone keys obstructed from view when said movable element is in the closed position; and

a controller, said controller coupled to said transceiver, said controller to control said first display area for displaying the information therein, wherein when an incoming call is detected by said transceiver and said movable element is moved from the closed position to the open position said portable electronic device operates to connect to the incoming call, transfer the information displayed in the first display area to the second display area, and turn off the first display area, wherein when the portable electronic device is outside of the holster the first display area is powered off by the controller and the second display area is powered on if the movable element is in the open position, and

when the portable electronic device is inserted into the holster the first display area is powered on by the controller while the second display area is powered off if the movable element is in the closed position.

2. The portable electronic device according to claim 1, wherein said first display area displays alphanumeric status information including at least one of date and time information, battery level indication, low battery warning indication, communication "in use" indication, roam indication, duration of the call, "units" of time used for the call, and an amount of money charged for the call.

3. The portable electronic device according to claim 1, wherein when a call is detected by said transceiver and said movable element is not moved after a predetermined timeout period, said controller initiates an immediate forwarding of the incoming call to a storage apparatus wherein one of a synthesized message is played to a caller and a voice message is recorded.

4. The portable electronic device according to claim 1, wherein said radio transceiver is to receive information

comprising at least one of messaging information and caller identification (ID) information of a calling unit upon receipt of a call therefrom, and wherein said controller to display said information in said first display area.

5. A portable radio communication device, comprising:

a housing, said housing defining a front side and a top side, said housing including a movable element movable between an open position and a closed position;

a controller, said controller disposed in said housing;

a transceiver, said transceiver disposed in said housing and coupled to said controller, said transceiver configured to detect a call from a calling unit and receive information corresponding thereto;

an antenna, said antenna coupled to said transceiver;

a first display area, said first display area exposed on said top side and operating in response to said controller; and

a second display area, said second display area exposed on said front side and operating in response to said controller,

the controller being responsive to an incoming call detected by the transceiver such that when the incoming call is detected the controller displays information corresponding to the call in the first display area for the user to see, and

a holster with electrical contacts to connect to the device, the holster to hold the communication device which is configured to insert into and electrically connect with the holster wherein,

when the radio communication device is outside of the holster and said movable element is moved from the closed position to the open position said controller directs said transceiver to connect to the incoming call, transfer the information displayed in the first display area to the second display area, and turn off the first display area, and when the portable electronic device is inserted into the holster the first display area is powered on by the controller while the second display area is powered off if the movable element is in the closed position,

when said movable element is moved from the open position to the closed position said controller directs said transceiver to terminate the call, and

when said movable element is not opened after a detection of the incoming call, said controller initiates an immediate forwarding of the incoming call to a storage apparatus wherein one of a synthesized message is played to a caller and a voice message is recorded.

6. The portable radio communication device according to claim 5, wherein said controller is to control said first display area to display visual information when said movable element is in the closed position, said visual information to include alphanumeric status information including at least one of date and time information, battery level indication, low battery warning indication, communication "in use" indication, roam indication, duration of the call, "units" of time used for the call, and an amount of money charged for the call.

7. The portable radio communication device according to claim 5, wherein said first display area comprises a single line light emitting diode (LED) display and said second display area comprises a liquid crystal display (LCD).

8. The portable radio communication device according to claim 5, wherein said first display area is configured to display information comprising at least one of messaging

information and caller identification (ID) information of a calling unit upon receipt of a call therefrom, and wherein said first display area is to display the information when said movable element is in the closed position.

9. A method for controlling operation of a transceiver along with a first display area and a second display area of a portable electronic device configured to insert into and electrically connect with a holster having electrical contacts to connect to the device located therewithin, the portable electronic device including a controller coupled to the transceiver and a movable element having an open and closed position, the first display area located on a first surface of the portable electronic device and the second display area located on a second surface of the portable electronic device, the method comprising the steps of:

controlling the first display area to turn on in response to the portable electronic device being positioned in the holster;

controlling the first display area to turn off in response to the portable electronic device being positioned outside of the holster;

controlling the first display area to display alphanumeric information of an incoming call detected by the transceiver when said movable element is in the closed position and the portable electronic device is positioned in the holster; and

controlling the transceiver to connect to the incoming call in response to the opening of the movable element, transfer the information displayed in the first display area to the second display area, and turn off the first display area.

10. The method according to claim 9, wherein the controlling steps controlling the first and second display areas to display at least one of short messaging information and caller identification (ID) information.

11. The method according to claim 9, wherein the step of controlling the first display area comprises the step of controlling the first display area to display status information including at least one of date and time information, battery level indication, low battery warning indication, communication "in use" indication, roam indication, duration of the call, "units" of time used for the call, and an amount of money charged for the call.

12. A method of controlling operation of a portable electronic device configured to insert into and electrically connect with a holster having electrical contacts to connect to the device located therewithin, the portable electronic device including a housing, a controller, a transceiver, a first display area, and a second display area, the first display area outwardly directed from a side of the housing, the second display area outwardly directed from a front of the housing, the housing including a movable element movable to an open position and a closed position, the second display area covered when the movable element is positioned in the closed position, the method comprising the steps of:

controlling the first display area to turn on in response to the portable electronic device being positioned into the holster;

controlling the first display area to turn off in response to the portable electronic device being positioned outside of the holster;

detecting an incoming call in the transceiver;

11

displaying information corresponding to the incoming call in the first display area when the movable element is in the closed position and covering the second display area and the portable electronic device is positioned into the holster;

directing said transceiver to connect to the incoming call in response to the opening of the movable element;

directing said controller to initiate an immediate forwarding of the incoming call to a storage apparatus where one of a synthesized message is played to a caller and a voice message is recorded, in response to a timeout before the opening of the movable element;

turning off said first display area in response to the opening of the movable element and turning on the second display area;

12

transferring the information displayed in the first display area to the second display area in response to the opening of the movable element; and

terminating the call in response to the closing of the movable element.

13. The method according to claim 12, wherein the step of displaying information includes the step of displaying information including at least one of short messaging information, caller identification (ID) information, date and time information, battery level indication, low battery warning indication, communication "in use" indication, roam indication, duration of the call, "units" of time used for the call, and an amount of money charged for the call.

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United States Patent [19][11] **Patent Number:** **5,857,148****Weisschappel et al.**[45] **Date of Patent:** **Jan. 5, 1999****[54] PORTABLE ELECTRONIC DEVICE AND METHOD FOR COUPLING POWER THERETO**

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455/351; 379/428; 429/9; 429/97; 429/123[58] Field of Search **455/89, 90, 95,**
455/127, 128, 344, 347, 348, 349, 351,
550, 572, 573, 574, 575, 38.1, 38.4; 429/9,
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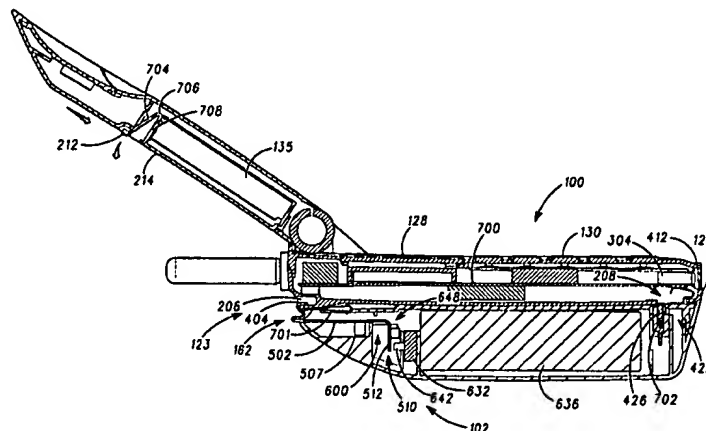
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NTT, Do Co Mo, *Digital*, 1994 (Japanese product brochure).*Primary Examiner*—Doris H. To*Attorney, Agent, or Firm*—Mark D. Patrick**[57] ABSTRACT**

A novel portable electronic device comprising a first housing portion (106) having a first battery (135) integrally associated with said first housing portion and a second housing portion (104) having a second battery (102) operatively coupled to an external surface of the second housing portion. Also, a method for coupling power to a portable electronic device comprises steps of providing a recessed region in a first housing portion for receiving a first battery and operatively coupling a second battery to an external surface of a second housing portion.

11 Claims, 11 Drawing Sheets

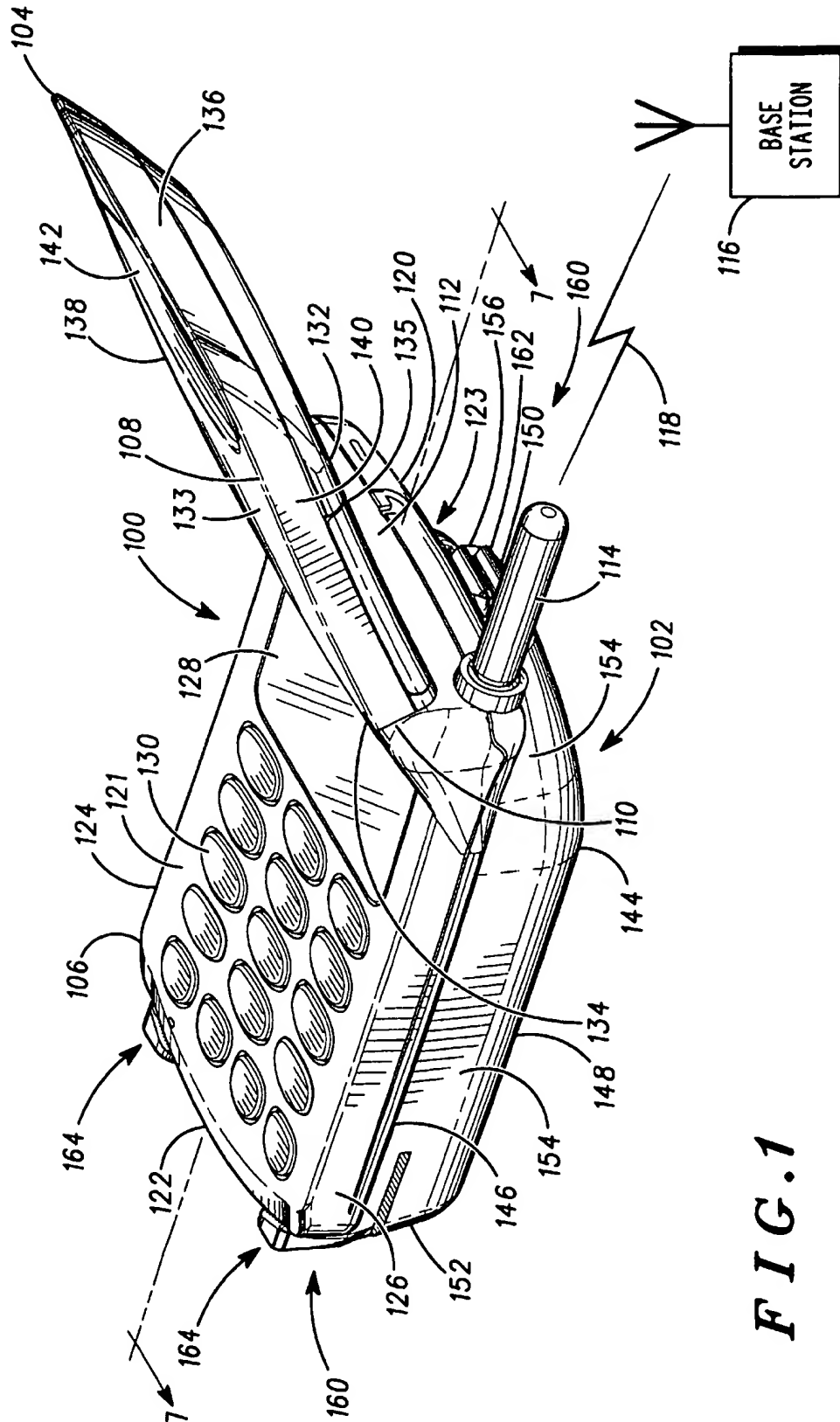
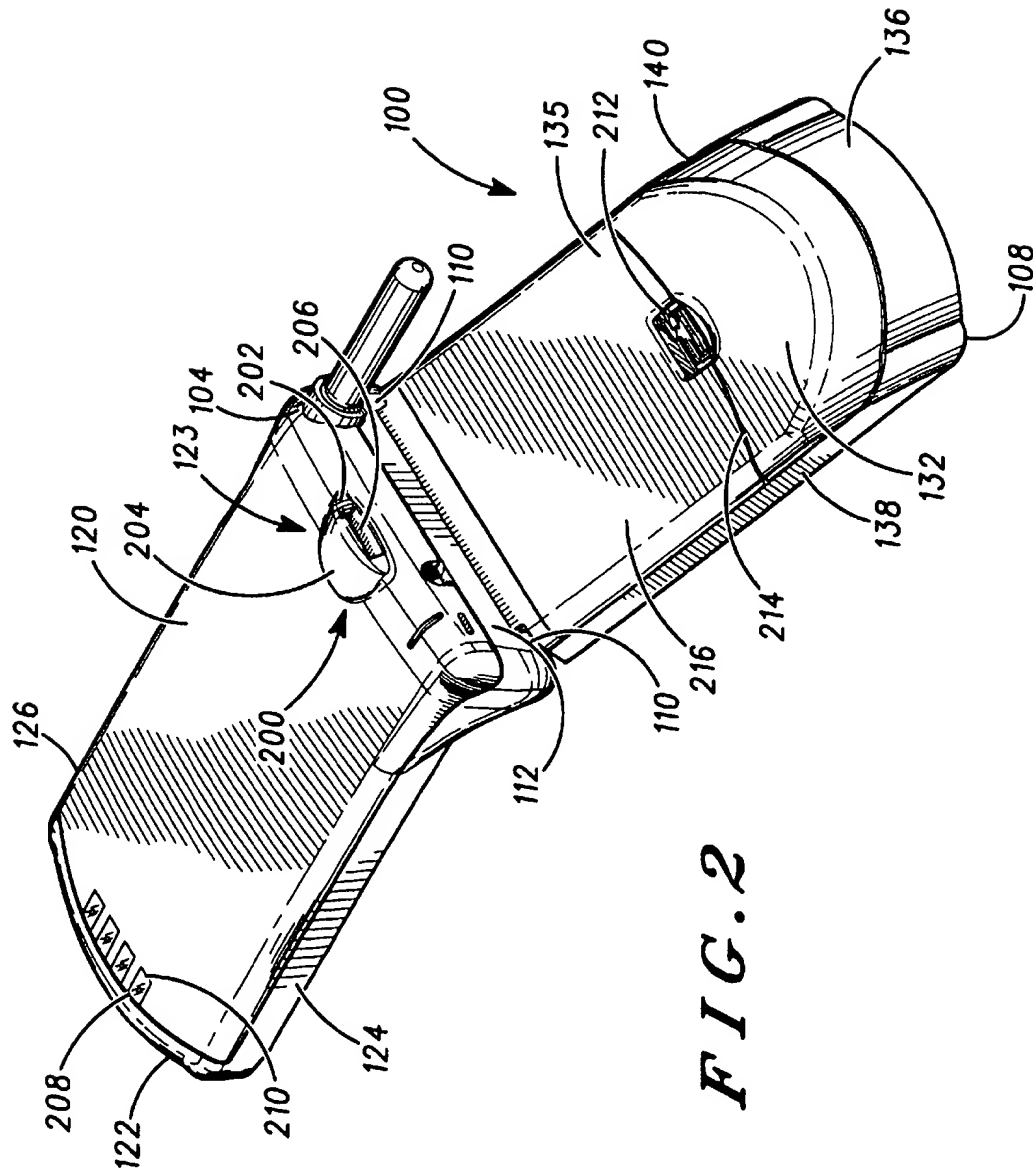
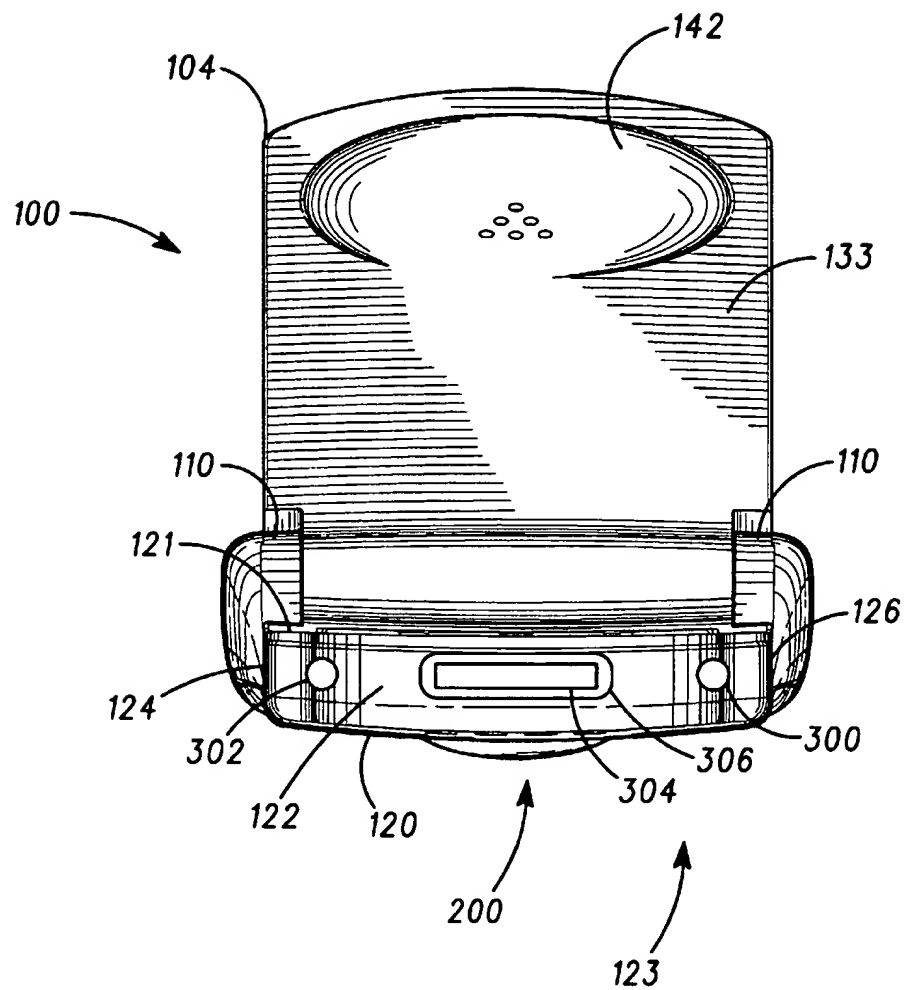


FIG. 1



**FIG. 3**

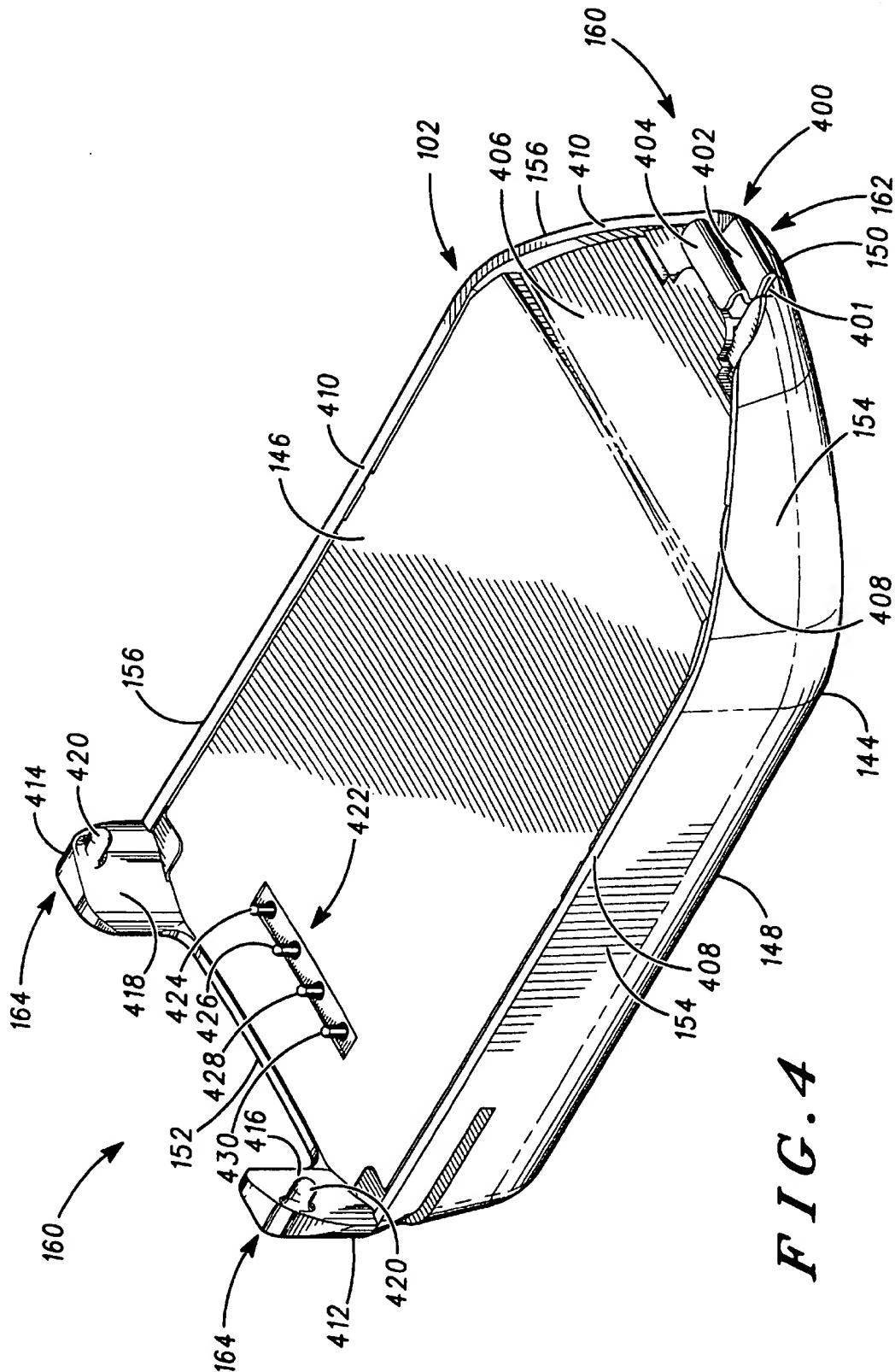


FIG. 4

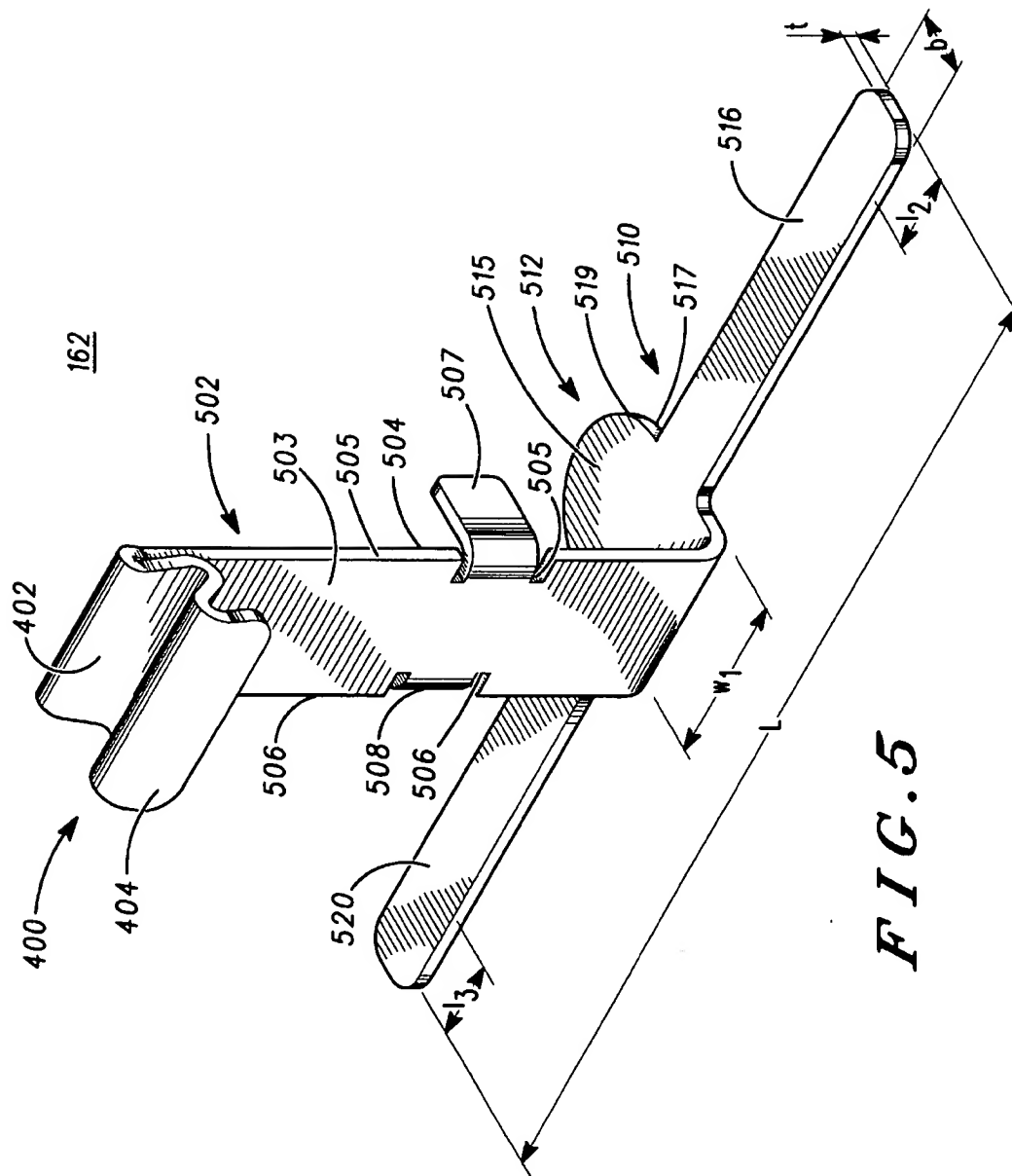


FIG. 5

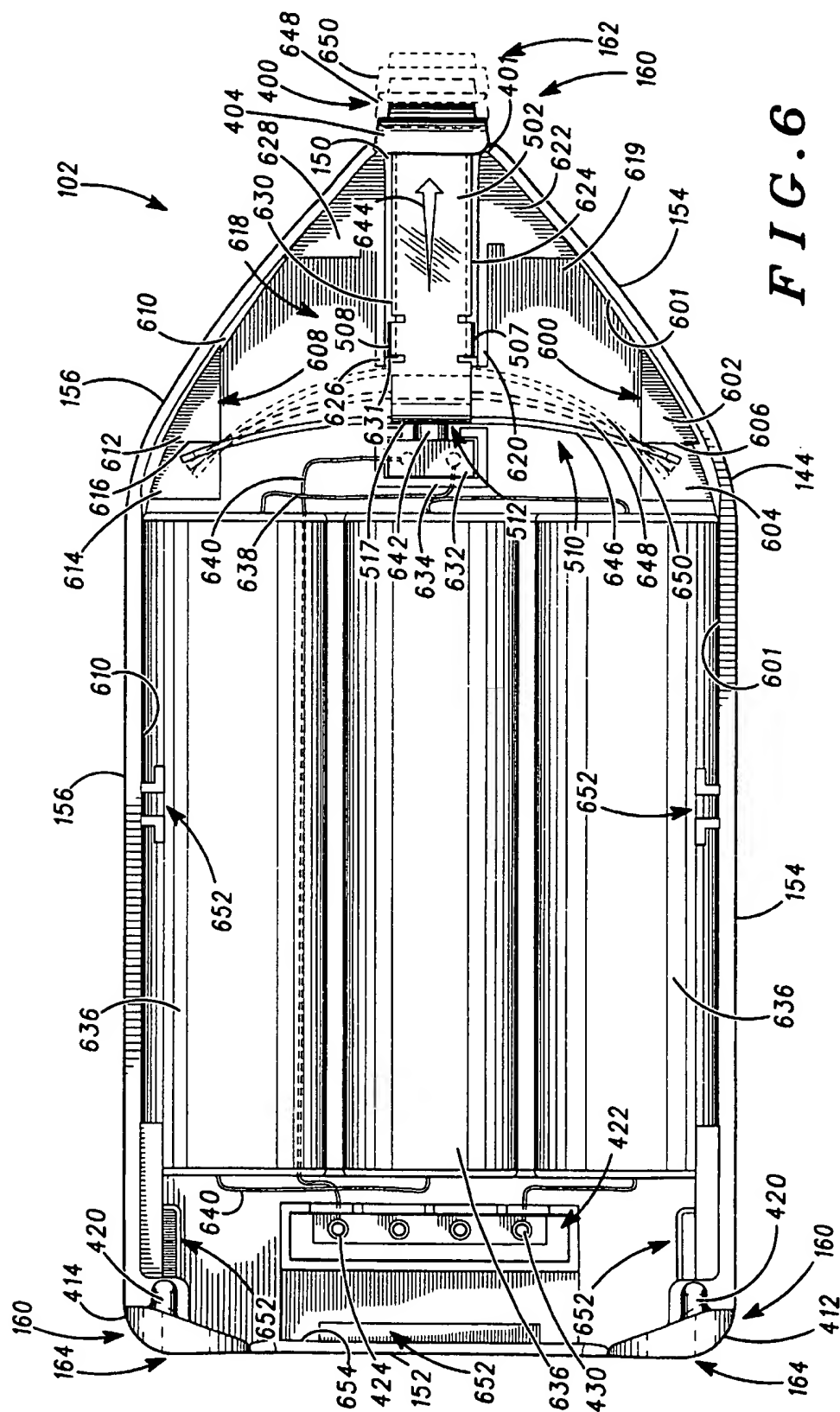
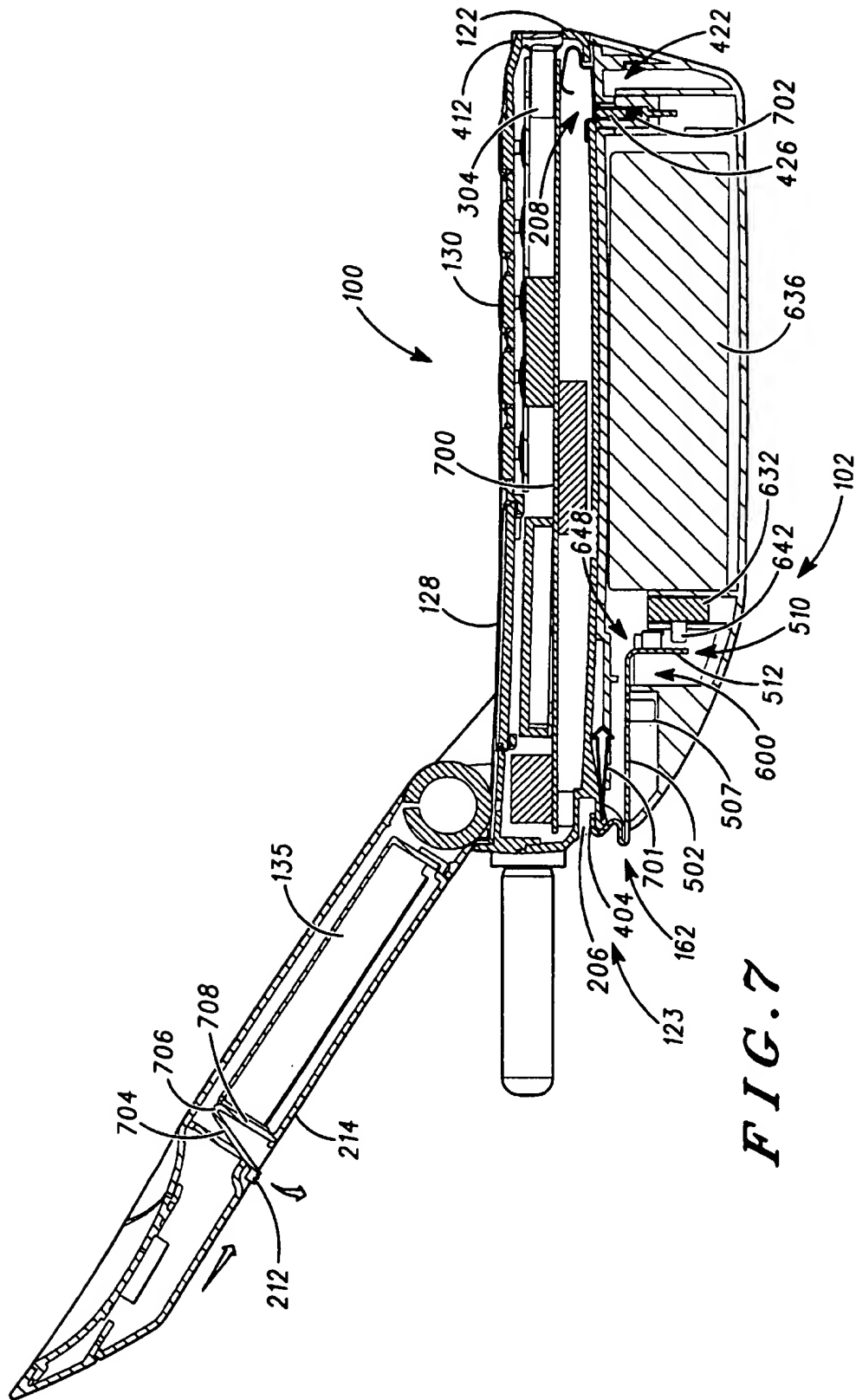
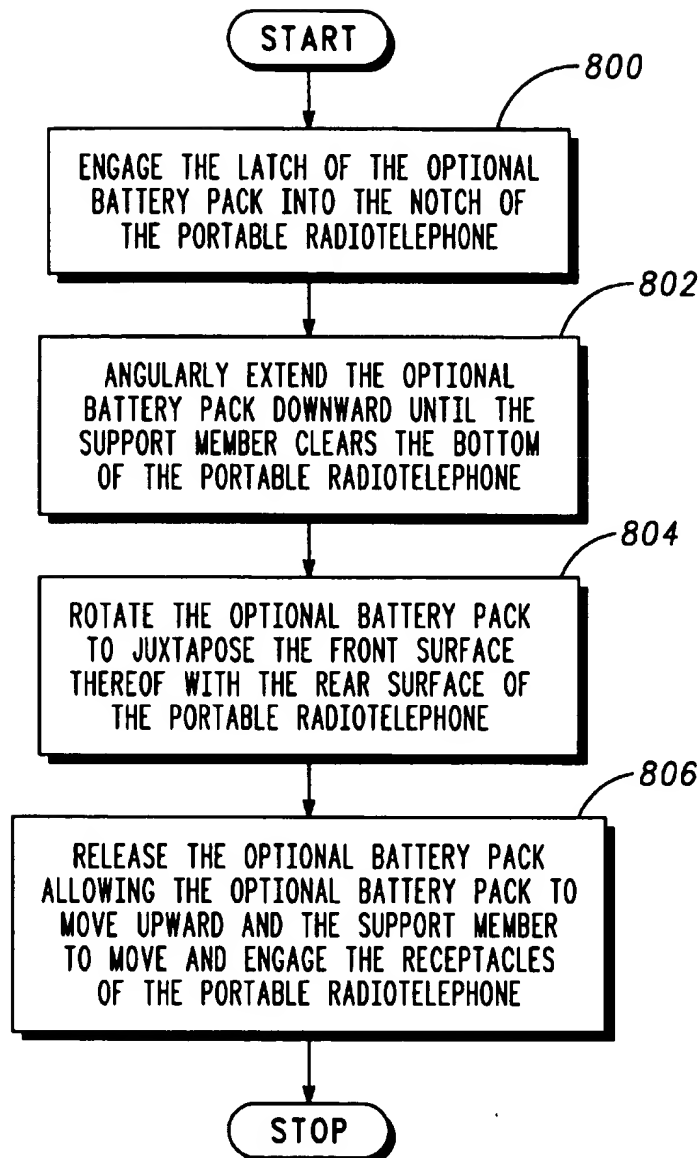
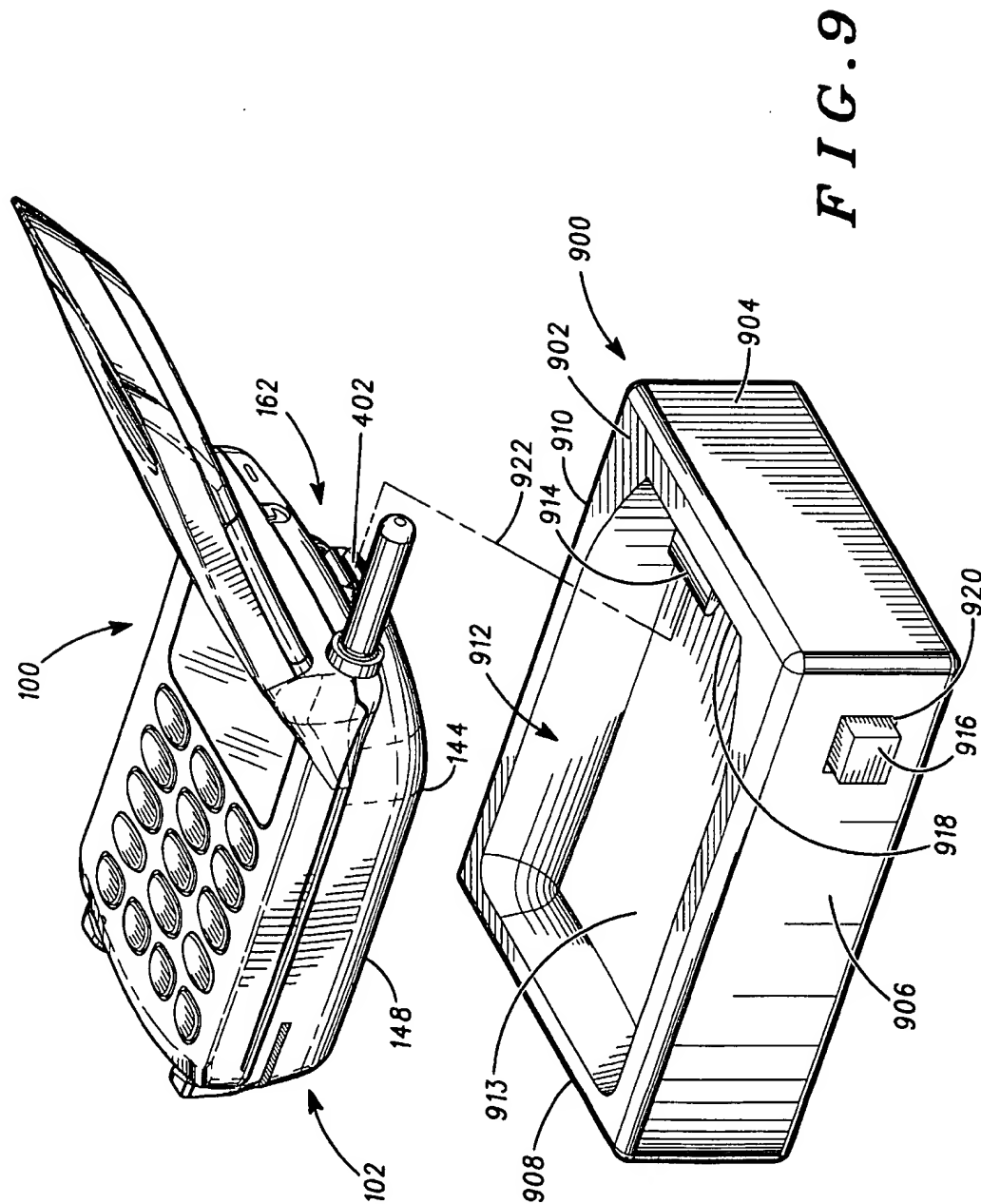
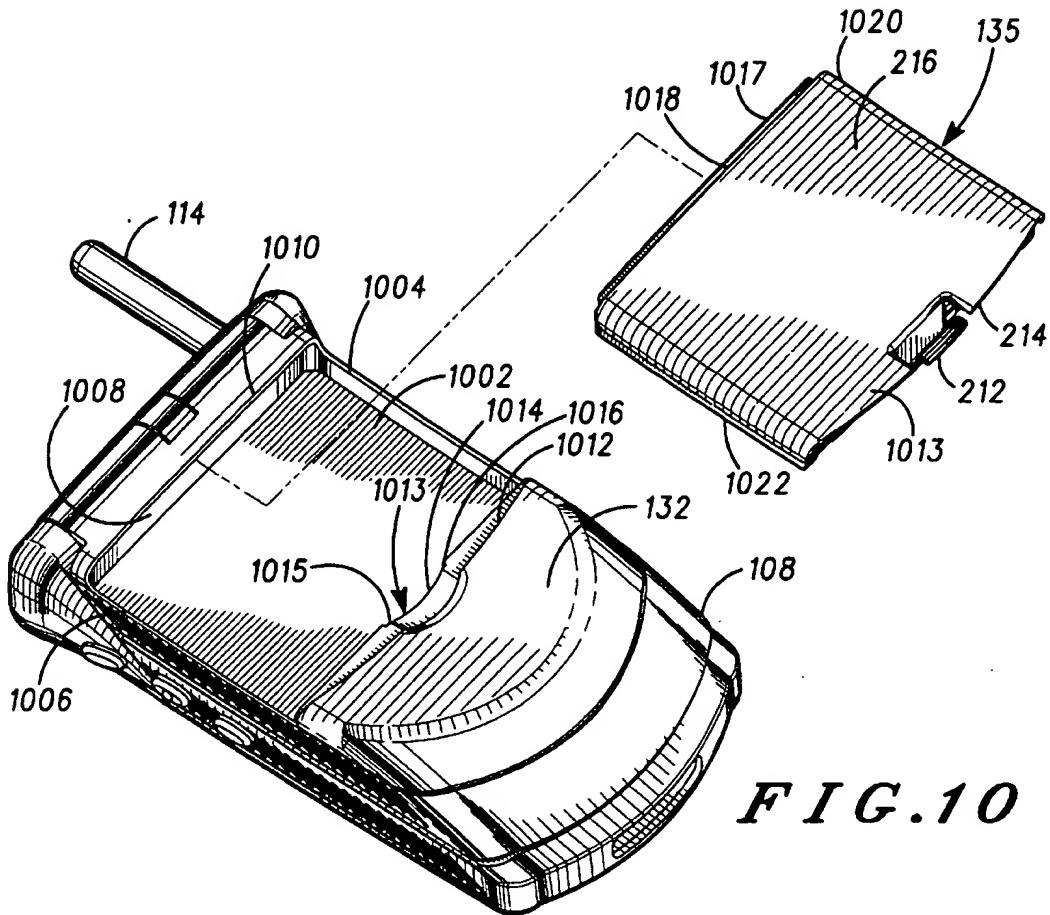
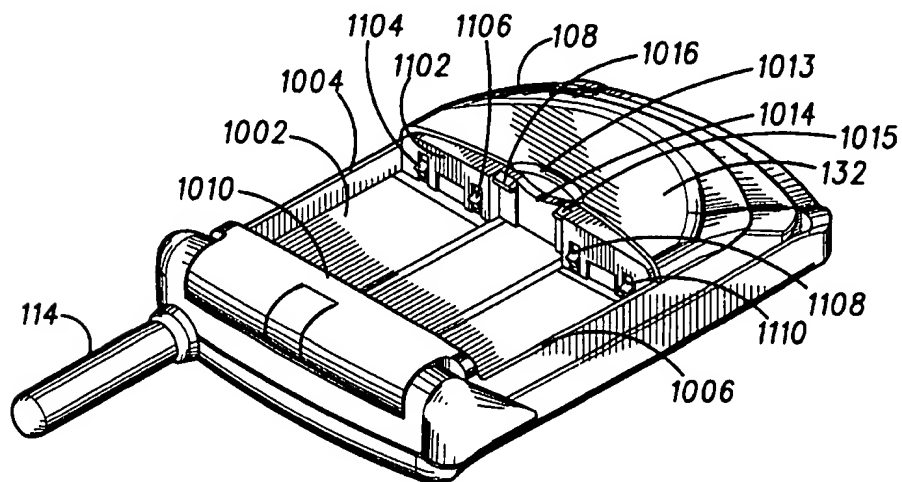


FIG. 6



*FIG. 8*



**FIG. 10****FIG. 11**

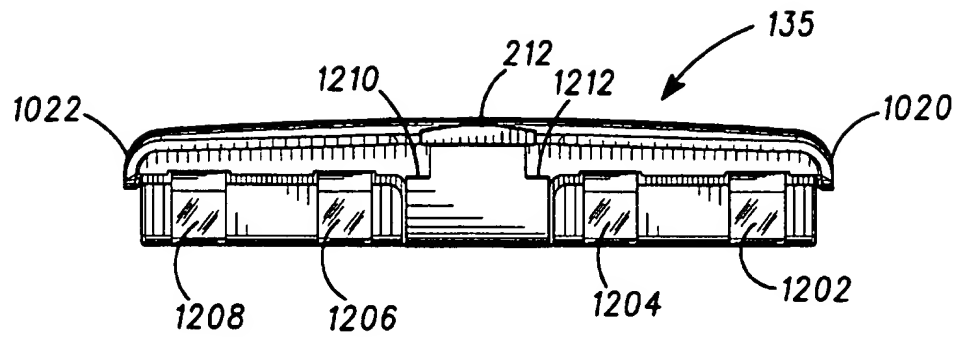


FIG. 12

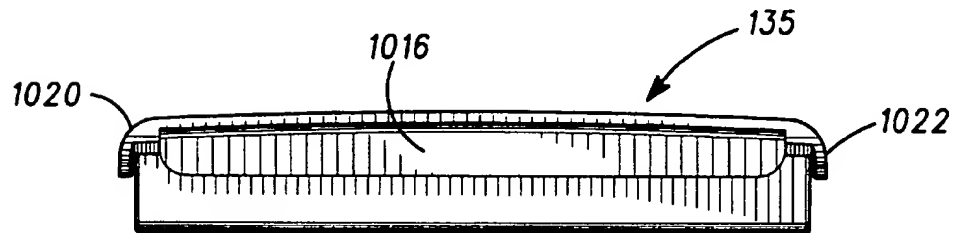


FIG. 13

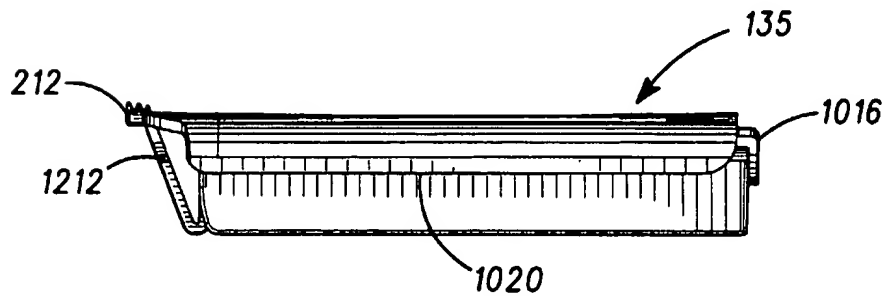


FIG. 14

PORTABLE ELECTRONIC DEVICE AND METHOD FOR COUPLING POWER THERE TO

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to portable electronic devices and more specifically to a device and method for coupling power to a portable electronic device.

2. Description of the Related Art

Consumer demands have fueled technological advances in the area of portable electronics. Through aggressive development and manufacturing, the industry has accomplished increased miniaturization of electronic components resulting in the advent of extremely lightweight and dimensionally constrained portable electronic devices, such as laptop computers and cellular radiotelephones. The current market has become inundated with a variety of the portable electronic devices from which the consumer can choose to purchase. Oftentimes the main selling points of the portable electronic device include operational features and cosmetic appearance.

One such operational feature of the portable electronic device is its duration of continuous operation, i.e., its amount of "talk" time and "standby" time. Portable electronic devices are typically powered by a rechargeable battery pack—multiple rechargeable electrochemical cells disposed within a housing—that is manufactured to attach to the portable electronic device. Because of the relatively large weight and size of rechargeable battery packs, current portable electronic devices typically only provide for attachment of a single, main rechargeable battery pack. Therefore, such portable electronic devices are limited to continuous operation only during the period between recharges of the main rechargeable battery pack. Such limitations are undesirable to a user that requires a longer duration of continuous operation and does not wish to sacrifice portability by having to carry additional rechargeable battery packs. Therefore, it would be beneficial to have a portable electronic device with increased of continuous operation without hampering its portability.

To increase the duration of continuous operation, it is known to attach an auxiliary rechargeable battery pack to the portable electronic device to supplement the main rechargeable battery pack in powering the portable electronic device. Current latching mechanisms for attaching rechargeable battery packs include parallel channels formed in the rechargeable battery pack that interlock with corresponding parallel rails disposed on the portable electronic device; and protruding members extending from the rechargeable battery pack that mate with indentations disposed about a cavity formed in the housing of the portable electronic device when the rechargeable battery pack is inserted into the cavity. However, because the auxiliary rechargeable battery pack is optional and need not always be attached to the portable electronic device for the portable electronic device to operate, current latching mechanisms are unacceptable for attaching an auxiliary rechargeable battery pack due to their adverse cosmetic impact. Without attachment of the auxiliary battery pack, for example, both the parallel rails on the portable electronic device and the housing cavity on the portable electronic device would remain unoccupied and exposed.

Therefore, what is needed is an effective latching mechanism for attaching an optional accessory, such as a rechargeable battery pack, to a portable electronic device, such that

the appearance of the portable electronic device is minimally affected when the optional accessory is not attached.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates a front and right side perspective view of a portable electronic device having an optional battery pack attached thereto.

FIG. 2 illustrates a rear, left side, and top perspective view of the portable electronic device.

FIG. 3 illustrates a bottom plan view of the portable electronic device.

FIG. 4 illustrates a front, right side, and top perspective view of the optional battery pack employing a latching mechanism.

FIG. 5 illustrates a front, right side, and top perspective view of a latch of the latching mechanism.

FIG. 6 illustrates a front elevational view of the optional battery pack having a front surface removed and multiple positions of the latch.

FIG. 7 illustrates a cross-sectional view of the portable electronic device and attached optional battery pack taken along section lines 1—1 of FIG. 1.

FIG. 8 illustrates a flow chart of a method of latching the optional battery pack to the portable electronic device.

FIG. 9 illustrates the portable electronic device having an optional battery pack attached thereto and an associated accessory.

FIG. 10 illustrates the portable electronic device in a closed position with a main battery pack detached showing the inside and rear wall of a recessed region for receiving the main battery pack;

FIG. 11 illustrates the portable electronic device in a closed position with a main battery pack detached showing the inside and front wall of the recessed region;

FIG. 12 illustrates a front elevational view of the main battery detached from the portable electronic device;

FIG. 13 illustrates a rear elevational view of the main battery detached from the portable electronic device; and

FIG. 14 illustrates a side elevational view of the main battery detached from the portable electronic device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A latching mechanism disposed on an optional accessory for attaching the optional accessory to a portable electronic device includes a support and a moveable latch that mate with a retaining device disposed on the portable electronic device. The support and moveable latch are disposed on opposite ends of the optional accessory. The retaining device includes receptacles and a notch disposed on opposite ends as well as different sides of the portable electronic device. The retaining device is sized and oriented to minimally impact the appearance of the portable electronic device when the optional accessory is not attached thereto. Attachment of the optional accessory to the portable electronic device is accomplished by engaging the moveable latch with the notch as well as contacting the support and the receptacles. The moveable latch exerts a force on the notch drawing the support into snug contact with the receptacles. The force is exerted in a plane parallel to a side of the optional accessory that extends between the ends thereof.

FIG. 1 illustrates a front and right side perspective view of a portable electronic device having an optional battery pack attached thereto. A portable radiotelephone 100 and an

optional battery pack 102 are shown attached in FIG. 1. The portable radiotelephone 100 includes a portable radiotelephone housing 104. The portable radiotelephone housing 104 is preferably molded from a suitable polymer material, such as polycarbonate. The portable radiotelephone housing 104 includes a lower housing portion 106 and an upper housing portion 108. The lower and upper housing portions 106, 108 are rotatably coupled via a hinge 110 disposed to extend planarly from a lower top end surface 112 of the lower housing portion 106. An antenna 114 extends perpendicularly from the lower top end surface 112. The antenna 114, which is coupled to a transceiver circuit 700 (see FIG. 7) disposed within the portable radiotelephone housing 104, permits the portable radiotelephone 100 to operate in a cellular radiotelephone environment by communicating with a fixed site cellular base station 116 via radio frequency waves 118.

The lower housing portion 106 includes a lower rear surface 120 and a lower front surface 121 extending downward from the lower top end surface 112 between a lower bottom end surface 122, a lower left surface 124, and a lower right surface 126. The lower rear surface 120 includes an optional battery pack retaining device 123 which will be further discussed in relation to FIGS. 2 and 3 below. The lower front surface 121 includes a display 128 disposed above a keypad 130. The display 128, which may be a liquid crystal display (LCD) or a light emitting diode (LED) type display, provides visual information to a user including, for example, the current amount of charge remaining in the optional battery pack 102. The keypad 130 allows the user to power the portable radiotelephone 100 on and off and initiate calls by inputting and sending numbers.

The upper housing portion 108 includes an upper rear surface 132 and an upper front surface 133 extending upward from the hinge 110 and between an upper bottom end surface 134, a sloped upper top end surface 136, an upper left surface 138, and an upper right surface 140. The upper rear surface 132 includes a main battery pack 135 which is removably attached thereto for providing power to the transceiver circuit 700 (see FIG. 7) of the portable radiotelephone 100. The main battery pack 135 and the portable radiotelephone housing 104 are manufactured so that the main battery pack 135 is flush with the upper rear surface 132 when attached. The upper front surface 133 includes a concave speaker bezel 142 having openings (see FIG. 3). Positioned behind the openings in the concave speaker bezel 142 and out of view is a speaker for providing audio communication to a user and from which a user may be audibly alerted that the main battery pack 135 or the optional battery pack 102 providing power to the portable radiotelephone 100 is nearing depletion.

The optional battery pack 102 includes an optional battery pack housing 144. The optional battery pack housing 144 is preferably molded from a suitable polymer material, such as polycarbonate. The optional battery pack housing 144 includes a front surface 146 and a rear surface 148 extending between a top end surface 150, a bottom end surface 152, a right side surface 154, and a left side surface 156. The optional battery pack 102 includes a latching mechanism 160 for attaching the optional battery pack 102 to the portable radiotelephone 100 so that the lower rear surface 120 of the portable radiotelephone housing 104 and the front surface 146 of the optional battery pack housing 144 are maintained in juxtaposition. The latching mechanism 160 includes a latch 162 extending outward from the top end surface 150 of the optional battery pack housing 144 and engaging the optional battery pack retaining device 123 of

the portable radiotelephone housing 104. The latching mechanism 160 further includes a support 164 extending planarly from the bottom end surface 152 of the optional battery pack housing 144 and abutting the lower bottom end surface 122 of the portable radiotelephone housing 104.

Although the portable radiotelephone 100 is illustrated and described hereinbelow, it will be recognized that any one of a number portable electronic devices, such as lap top computers, camcorders, pagers, two way radios, personal digital assistants, and the like, could utilize the latching mechanism 160 and the method of latching described hereinbelow for attaching any accessory thereto, including a battery pack.

FIG. 2 illustrates a rear, left side, and top perspective view of the portable radiotelephone 100. The optional battery pack retaining device 123 is further shown in FIG. 2. The optional battery pack retaining device 123 includes a raised area 200 integrally formed with the lower rear surface 120 and located in proximity to the lower top end surface 112. The raised area 200 includes an elliptical face surface 202 extending outward from the lower rear surface 120 and a ramped portion 204 sloping back downward from the elliptical face surface 202 to the lower rear surface 120. The elliptical face surface 202 includes a notch 206 that faces in an upward direction but extends downward toward the lower bottom end surface 122. The notch 206 serves as a receptacle for the latch 162 of the latching mechanism 160. By providing the raised area 200, space within the portable radiotelephone housing 104 is conserved. Aside from the raised area 200, the lower rear surface 120 is devoid of any other latching receptacles that would detract from the appearance of the portable radiotelephone 100 when the optional battery pack 102 is not attached thereto.

Placing concerns about space savings aside, it will be recognized that the notch 206 could also be disposed in either the lower rear surface 120 or the lower top end surface 112 to extend within the portable radiotelephone housing 104 and towards the lower bottom end surface 122. Placed as such, the notch 206 would be equally capable of receiving the latch 162 of the latching mechanism 160 (see FIG. 1).

FIG. 2 also illustrates a set of flat contacts 208 disposed behind a series of openings 210 in the lower rear surface 120 in proximity to the lower bottom end surface 122. The set of flat contacts 208 are electrically connected to the transceiver circuit 700 (see FIG. 7) disposed within the portable radiotelephone housing 104. Upon attachment of the optional battery pack 102, the portable radiotelephone 100 is able to operate via power supplied to the set of flat contacts 208 by the optional battery pack 102. The set of flat contacts 208 are further discussed below in relation to FIG. 7.

Also shown in FIG. 2 is main battery 135 associated with upper housing portion 108. A latch member 212 at a distal end portion 214 of the main battery operatively mates with an associated latch member 216 of upper portion 108. Although outer surface 216 of main battery 135 forms a flush surface with upper rear surface 132, outer surface 216 of main battery 135 could extend above upper surface 132 to provide additional room for more or larger cells to provide greater capacity. The coupling of main battery 135 will be described in more detail in reference to FIGS. 10-14.

FIG. 3 illustrates a bottom plan view of the portable radiotelephone 100. The optional battery pack retaining device 123 is further shown in FIG. 3. The optional battery pack retaining device 123 includes a right receptacle 300 and a left receptacle 302 formed in the lower bottom end surface 122 in proximity to the lower right surface 126 and

5

the lower left surface 124, respectively. The right and left receptacles 300, 302 extend into the lower housing portion 106 towards the lower top end surface 112 (see FIG. 7). By positioning the right and left receptacles 300, 302 on the lower bottom end surface 122 the appearance of the portable radiotelephone 100 is minimally impacted when the optional battery pack 102 is not attached. The right and left receptacles 300, 302 are of a diameter that is sized to permit insertion of a portion of the support 164 of the optional battery pack 102.

FIG. 3 also illustrates an external connector 304 disposed behind an opening 306 in the lower bottom end surface 122. The external connector 304 is connected to the transceiver board 700 (see FIG. 7) and allows the user to attach the portable radiotelephone 100 to an external power source, such as the battery of an automobile (not shown), for operating the portable radiotelephone 100 or charging the main battery pack 135. Such attachment can be accomplished by attaching a cigarette lighter adapter cable (not shown) between the external connector 304 and a cigarette lighter plug (not shown) of the automobile. The external connector 304 may also be used to couple the portable radiotelephone 100 to a hands free user interface (not shown) mounted in the automobile. The hands free user interface assists the user in many of the routine operations of the portable radiotelephone 100.

FIG. 4 illustrates a front, right side, and top perspective view of the optional battery pack 102. The latching mechanism 160 of the optional battery pack 102 is further shown in FIG. 4. The latch 162 of the latching mechanism 160 includes a catch 400 that extends upward through a top opening 401 in the top end surface 150. The catch 400 includes a receptacle 402 adjacent to a hooked end 404. The hooked end 404 extends toward the bottom end surface 152 and, in the preferred embodiment, is substantially parallel to the front surface 146 of the optional battery pack housing 144. The hooked end 404 is sized to engage the notch 206 of the raised area 200 of the optional battery pack retaining device 123 (see FIG. 2). To accommodate the raised area 200 of the portable radiotelephone 100, the optional battery pack housing 144 includes a recessed area 406 allowing edges 408 and 410 of the right and left side surfaces 154, 156, respectively, to perpendicularly abut the lower rear surface 120 of the portable radiotelephone 100 when the optional battery pack 102 is attached thereto, as shown in FIG. 1.

The support 164 of the latching mechanism 160 includes a right foot 412 and a left foot 414 extending planarly from the bottom end surface 152 and the respective edges 408, 410 of the right and left side surfaces 154, 156. The right and left feet 412, 414 are substantial mirror images of one another. The right and left feet 412, 414 include a right ramped top surface 416 and a left ramped top surface 418, respectively. The right and left ramped top surfaces 416, 418 slope downwards from the respective edges 408, 410 and are contoured to tightly abut the lower bottom end surface 122 of the portable radiotelephone 100 which is curved (see FIG. 2). The right and left feet 412, 414 are sized and oriented to allow access to, and prevent obstruction of, the external connector 304 (see FIG. 3) when the optional battery pack 102 is attached.

A cylindrical prong 420 extends upward from each of the right and left ramped top surfaces 416, 418. The cylindrical prong 420 extends perpendicular to the bottom end surface 152 of the optional battery pack housing 144 and parallel to the front surface 146 of the optional battery pack housing 144. During attachment of the optional battery pack 102 to

6

the portable radiotelephone 100, the cylindrical prong 420 of each of the right and left ramped top surfaces 416, 418 inserts into the right and left receptacles 300, 302, respectively, as the right and left ramped top surfaces 416, 418 move into abutment with the lower bottom end surface 122 of the portable radiotelephone 100 (see FIGS. 2 and 3). The cylindrical prong 420 has a diameter that is sized slightly smaller than the right and left receptacles 300, 302 to ensure a snug fit therein.

Putting concerns of obstructing the external connector 304 aside, it will be recognized that the support 164 of the latching mechanism 160 could comprise a single foot (not shown) extending planarly from the bottom end surface 152 to abut all or a portion of the lower bottom end surface 122. The single foot could include either a single oblong cylindrical prong or multiple cylindrical prongs, each similar to cylindrical prong 420, that insert into a corresponding single oblong receptacle or corresponding multiple receptacles, each similar to the right and left receptacles 300, 302 disposed in the portable radiotelephone 100.

FIG. 4 further illustrates a set of projecting contacts 422 extending from the front surface 146 of the optional battery pack housing 144. The set of projecting contacts 422, as shown, consists of a positive contact 424, a thermistor sense contact 426, a data contact 428, and a negative or ground contact 430. Positive and negative polarities of a plurality of electrochemical cells 636 (see FIG. 6) disposed within the optional battery pack housing 144 are coupled to the respective positive and negative contacts 424, 430. A thermistor (not shown) disposed within the optional battery pack housing 144 is coupled between the negative polarity and the thermistor sense contact 426 for providing a resistance that may be used by a charger (not shown) to determine the temperature of the plurality of electrochemical cells 636 while the optional battery pack 102 is being charged. A resistive network or microprocessor (not shown) indicating the type of the plurality of electrochemical cells disposed within the optional battery pack housing 144 may be coupled to the data contact 428 to provide the identity of the plurality of electrochemical cells 636 to both the charger and the portable radiotelephone 100 for charging and discharging optimization. Upon attachment of the optional battery pack 102 to the portable radiotelephone 100, the contacts of the set of projecting contacts 422 of the battery pack 102 mate with respective contacts of the set of flat contacts 208 of the portable radiotelephone 100 (see FIG. 2).

FIG. 5 illustrates a front, right side, and top perspective view of the latch 162 of the latching mechanism 160. The latch 162 may be progressively stamped from beryllium copper alloy and heat treated, such as Brush Alloy 25 manufactured and sold by Brush Wellman Inc. Aside from the catch 400, the latch 162 includes an arm 502 and a crossbar 510. The arm 502 extends vertically between a midpoint of the crossbar 510 and the catch 400. The arm 502 includes a front surface 503 and a rear surface 504 with a right edge 505 and a left edge 506 extending therebetween. A first guide flange 507 and a second guide flange 508 extend outward and orthogonally rearward from opposing locations on the right and left edges 505, 506, respectively.

The crossbar 510 extends horizontally with respect to the arm 502. The midpoint of the crossbar 510 is defined by a central hub 512 that extends orthogonally rearward from an end of the arm 502 opposite the catch 400. The central hub 512 has a width that is equal to that of the arm 502. The central hub 512 includes a top surface 515 and a bottom surface 517 interconnected by a curved edge 519. A first finger 516 extends coplanarly rightward from the curved

edge 519. A second finger 520, which is substantially a mirrored image of the first finger 516, extends coplanarly leftward from the curved edge 519 directly opposite to the first finger 516. The first and second fingers 516, 520 are of a width that is less than that of the central hub 512.

The crossbar 510 is dimensioned to allow the first and second fingers 516, 520 to flex in a plane perpendicular to the central hub 512. When ends of the crossbar 510 are supported or anchored, a perpendicular force applied to either the top or bottom surfaces 515, 517 of the central hub 512 causes the crossbar 510 to bow and the central hub 512 to deflect. Removal of the perpendicular force causes the crossbar 510 to straighten. The crossbar 510 operates as a spring that is biased towards the straightened position. Therefore, when the central hub 512 is deflected above the ends of the crossbar 510, the crossbar 510 exerts a downward force. This downward force is translated to the hooked end 404 of the catch 400 via the arm 502 and enables sufficient latching of the optional battery pack 102 to the portable radiotelephone 100.

To determine the downward force necessary to maintain the optional battery pack 102 in attachment to the portable radiotelephone 100, the following factors were considered: the weight of the optional battery pack 102; the spring force of the set of projecting contacts 422; the amount of surface area of the support 164; the length and quantity of the cylindrical prongs 420 of the support 164; the orientation of the cylindrical prongs 420 and the hooked end 404; and the depth and orientation of the notch 206 and the right and left receptacles 300, 302 of the optional battery pack retaining device 123. In view of the factors, a force of approximately 22 N was determined to be sufficient.

To calculate the dimensions of the crossbar 510 necessary to exert approximately 22 N of force while the optional battery pack 102 is attached to the portable radiotelephone 100, the crossbar 510 was modeled as a leaf spring. The leaf spring is governed by the following known equation (derived from *Machinery's Handbook* by Erik Oberg and F. D. Jones, 1970, Industrial Press Inc.):

$$L = \sqrt[3]{\frac{4Ebt^3\delta}{F}}$$

where

L is the length of the leaf spring,
E is the modulus of elasticity of the leaf spring,
b is the width of the leaf spring, and
t is the thickness of the leaf spring,
 δ is the deflection at the center of the leaf spring,

and

F is force.

For clarity, the dimensions of the leaf spring recited hereinbelow are specified in FIG. 5.

In solving the equation, the following assumptions were made:

1. The length L of the leaf spring is reduced by width w1 of the central hub 512 (6 mm) which remains rigid during the bowing of the crossbar 510 and by lengths l2 and l3 of the crossbar 510 (2 mm and 2 mm) which are supported or anchored during the bowing of the crossbar 510.

2. The modulus of elasticity (E) is approximately 1.32E5 N/mm² for beryllium-copper alloy having a thickness (t) of 0.5 mm.

3. The width of the leaf spring (b) is 2.75 mm.

4. The deflection at the center of the leaf spring (δ) is 3 mm when the latch 162 is extended to the engaged position 648 (see FIG. 6).

5. The force (F) is 22 N.

These assumptions result in the following:

$$L - (6\text{mm} + 2\text{mm} + 2\text{mm}) =$$

$$\sqrt[3]{\frac{4(1.32\text{E}5\text{N/mm}^2)(2.75\text{mm})(0.5\text{mm})^3(3\text{mm})}{22\text{N}}}$$

$$L = 29.14\text{mm} + 10\text{mm} = 39.14\text{mm}.$$

FIG. 6 illustrates a front elevational view of the optional battery pack 102 having a front surface 146 removed and multiple positions of the latch 162. The optional battery pack housing 144 is molded to engage the latch 162. The optional battery pack housing 144 includes a first anchor 600 disposed on a right side inner surface 601 thereof. The first anchor 600 is formed by a right triangular front ledge 602 and a right triangular rear ledge 604 offset and interconnected by a right wall 606. A second anchor 608, which is substantially a mirrored image of the first anchor 600, is disposed on a left side inner surface 610 directly opposite the first anchor 600. The second anchor 608 is formed by a left triangular front ledge 612 and a left triangular rear ledge 614 offset and interconnected by a left wall 616.

The optional battery pack housing 144 includes a track 618 that extends downward from the top opening 401 in the top end surface 150 in a direction that is coplanar with the front surface 146 (when attached). The track 618 further extends perpendicularly rearward with respect to the front surface 146 to a rear inner surface 619 of the rear surface 148. Right and left parallel edges of the track 618 are defined by a right rail 620 and a left rail 626, respectively. The right and left rails 620, 626 extend orthogonally frontward from the track 618. A right shelf 622 extends between an upper portion of the right rail 620 and the right side inner surface 601. A left shelf 628, opposite the right shelf 622, extends between an upper portion of the left rail 626 and the left side inner surface 610. A right trough 624 and a left trough 630 adjoining and extending along the right and left rails 620 and 626, respectively, are disposed in the track 618. The right and left troughs 624, 630 extend between the top opening 401 and a stop 631, which is disposed on an end of the track 618 opposite the top opening 401. The stop 631, which is flush with the track 618, extends perpendicularly rearward therefrom to the rear inner surface 619.

The optional battery pack 102 includes a switch 632 for preventing the optional battery pack 102 from providing power when it is not attached to the portable radiotelephone 100. The switch 632 is positioned at a predetermined distance beneath the stop 631. The switch 632 is held in a U-shaped channel 634 that extends frontward from the rear inner surface 619. The switch 632 is electrically coupled between a first wire 638 carrying a positive polarity of the plurality of electrochemical cells 636 and a second wire 640 coupled to the positive contact 424 of the set of projecting contacts 422. The switch 632 includes a button 642 extending from a top surface thereof. When the button 642 is depressed, the switch 632 is placed in an opened state wherein the first wire 638 and the second wire 640 are electrically disconnected such that the positive polarity of a plurality of electrochemical cells 636 is not delivered to the positive contact 424. When the button 642 is not depressed, the switch 632 is placed in a closed state wherein the first wire 638 and the second wire 640 are electrically connected such that the positive polarity of a plurality of electrochemical cells 636 is delivered to the positive contact 424.

Although the switch 632 is disclosed as an electromechanical switch, it will be recognized that switching could be

accomplished by a microprocessor circuit (not shown) disposed within the optional battery pack 102. The microprocessor circuit detects attachment of the optional battery pack 102 to the portable radiotelephone 100 via, for example, an optical sensor (not shown) or a magnetic reedswitch (not shown) coupled thereto and connects or disconnects the plurality of electrochemical cells 636 accordingly.

The latch 162 is assembled into the optional battery pack housing 144 as follows. The latch 162 is first positioned such that the arm 502 is generally juxtaposed with the track 618 between the right and left rails 620, 626. Also, the ends of the crossbar 510 rest on the right and left triangular rear ledges 604, 614 and curved edge 519 of the central hub 512 contacts the side of the button 642 of the switch 632. The latch 162 is then rotated about the crossbar 510 causing the catch 400 to move frontward (out of the page) while a force in a direction of arrow 644 is applied on the central hub 512 until the first and second guide flanges 507, 508 clear the stop 631 and curved edge 519 clears the button 642. During the rotation and application of the force, the crossbar 510 bows about the central hub 512 causing the ends thereof to tightly abut the right and left walls 606, 616, respectively, and causing the central hub 512 to be vertically deflected. Assembly of the latch 162 into the optional battery pack housing 144 is completed when the bottom surface 517 of the central hub 512 depresses the button 642 of the switch 632 and the first and second guide flanges 507, 508 inserts into the right and left troughs 624, 630, respectively, and rest against a top surface of the stop 631.

The latch 162 is further maintained in assemblage by the front surface 146 (see FIG. 4) of the optional battery pack housing 144. The optional battery pack housing 144 includes mounts 652 extending from the inner right side surface 601, the inner left side surface 610, and an inner bottom surface 654 of the bottom end surface 152. The mounts 652 mate with snaps (not shown) positioned about a periphery of an underside of the front surface 146. To assemble the front surface 146 to the optional battery pack housing 144, the front surface 146 is positioned such that a central groove (not shown) formed on the underside of the front surface 146 beneath the recessed area 406 engages the right and left rails 620, 626. The front surface 146 is then angled slightly and slid such that a right flap and a left flap (not shown), which are formed to extend upward from the underside of the recessed area 406 on either side of the groove, are drawn under the right and left shelves 622, 628, respectively, of the optional battery pack housing 144. The front surface 146 is then angled back rearwardly until the snaps on the underside of the front surface 146 mate with the mounts 652. Once the front surface 146 is attached, the arm 502 is maintained in juxtaposition with the track 618 and the first and second guide flanges 507, 508 are maintained in the right and left troughs 624, 630, respectively. The latch 162 is restricted to movement in a plane that is parallel to the front surface 146 and perpendicular to the top end surface 150.

Once assembled, the latch 162 resides in a rest position 646 that is defined by a slight deflection of the central hub 512 above the ends of the crossbar 510 as shown in FIG. 6. In the rest position 646, the optional battery pack 102 is unattached from the portable radiotelephone 100. The first and second guide flanges 507, 508 abut the top surface of the stop 631. The button 642 of the switch 632 is depressed by the bottom surface 517 of the central hub 512 disconnecting the plurality of electrochemical cells 636 from the set of projecting contacts 422. By disconnecting the plurality of electrochemical cells 636 when the optional battery pack 102 is unattached, discharging and adverse heating of the

optional battery pack 102 is prevented should the set of projecting contacts 422 come into contact with a foreign conductive object while the optional battery pack 102 is being carried on the user.

When attaching the optional battery pack 102 to the portable radiotelephone 100, the latch 162 is first extended from the rest position 646 to an engaging/disengaging position 650 and then released to an engaged position 648, both of which are shown in dotted line in FIG. 6. The range of extension of the latch 162 is defined by deflection of the central hub 512 between the rest position 646 and a bottom surface of the stop 631. Any extension of the latch 162 from the rest position 646 causes the first and second guide flanges 507, 508 to move upward in the right and left troughs 624, 630, respectively, away from the stop 631; the ends of the crossbar 510 to pivot about the right and left walls 606, 616; and the central hub 512 to further deflect and release the button 642 of the switch 632. Once the button 642 is released as shown in dotted line in FIG. 6, the plurality of electrochemical cells 636 are connected to the set of projecting contacts 422 and power may be provided therefrom.

The engaging/disengaging position 650 describes the position of the latch 162 and the amount of deflection of the central hub 512 when the optional battery pack 102 is being attached to, or detached from, the portable radiotelephone 100. In the engaging/disengaging position 650, the latch 162 is extended beyond the engaged position 648 to, among other things, permit alignment of the cylindrical prong 420 of the right and left feet 412, 414 of the support 164 of the optional battery pack 102 beneath the respective right and left receptacles 300, 302 of the optional battery pack retaining device 123 of the portable radiotelephone 100.

FIG. 7 illustrates a cross-sectional view of the portable radiotelephone 100 and attached optional battery pack 102 taken along section lines 1—1 of FIG. 1. The engaged position 648 describes the position of the latch 162 and the amount of deflection of the central hub 512 of the crossbar 510 when the optional battery pack 102 is attached to the portable radiotelephone 100. In the engaged position 648, the hooked end 404 of the latch 162 engages the notch 206 of the optional battery pack retaining device 123 with a force 701 (approximately 22 N), to maintain the optional battery pack 102 in attachment with the portable radiotelephone 100. The force 701 imparted by the hooked end 404 on the notch 206 and the surrounding elliptical face surface 202 effectively pushes both the right and left receptacles 300, 302 (see FIG. 3) around the cylindrical prongs 420 of the right and left feet 412, 414 of the support 164 (see FIG. 4) and the lower bottom end surface 122 of the portable radiotelephone 100 into snug abutment with the right and left ramped top surfaces 416, 418 of the right and left feet 412, 414 of the support 164.

When in the engaged position 648, the set of projecting contacts 422 of the optional battery pack 102 are in electrical contact with the set of flat contacts 208 of the portable radiotelephone 100. Each of the set of projecting contacts 422 are spring loaded to depress from a fully extended position (see FIG. 4) upon contact with the set of flat contacts 208 so as to minimize the force required to maintain the optional battery pack 102 in attachment with the portable radiotelephone 100. The operation of all of the contacts of the set of projecting contacts 422 is exemplified in FIG. 7, which shows the thermistor sense contact 426 in a depressed position. A spring 702 is disposed beneath the thermistor sense contact 426 to permit easy depression thereof upon contact with a corresponding contact of the set of flat contacts 208. The spring 702 biases the thermistor sense

contact 426 towards the fully extended position such that when depressed, the thermistor sense contact 426 is still maintained in electrical contact with the corresponding contact of the set of flat contacts 208.

Once attached, the plurality of electrochemical cells 636 of the optional battery pack 102 preempt the main battery pack 135 and the optional battery pack 102 powers the portable radiotelephone 100. This is accomplished by a fast switch (not shown) that is coupled between the main and optional battery packs 135, 102 and the transceiver board 700 and is controlled by the transceiver board 700. Therefore, when both the main and optional battery packs 135, 102 are coupled to the transceiver board 700, the portable radiotelephone 100 operates from the optional battery pack 102. Prior to complete discharge and/or removal of the optional battery pack 102, the fast switch automatically switches from the optional battery pack 102 to the main battery 135 without interrupting the operation of the portable radiotelephone 100. Once removed, the optional battery pack 102 may be recharged while the portable radiotelephone 100 operates via power provided by the main battery pack 135. Once recharged, the optional battery pack 102 can be reattached and switched to power the portable radiotelephone 100. While attached to the portable radiotelephone 100, the main and optional battery packs 135, 102 may be charged by attaching a charger to the external connector 304 of the portable radiotelephone 100. When charged in this manner, the transceiver board 700 charges the main battery pack 135 to completion prior to switching and charging the optional battery pack 102. Main battery pack 135 may also be removed by applying pressure to a lever arm 704 which is coupled by a fulcrum 706 to a fixed portion 708 of the main battery. The battery is tilted downward as shown and removed.

FIG. 8 illustrates a flow chart of a method of latching the optional battery pack 102 to the portable radiotelephone 100. Initially, the hooked end 404 of the latch 162 of the latching mechanism 160 (see FIG. 3) is inserted into the notch 206 of the optional battery pack retaining device 123 (see FIG. 2), at step 800.

The optional battery pack 102 is then pulled downward at an angle until the cylindrical prongs 420 of the right and left feet 412, 414 of the support 164 of the latching mechanism 160 (see FIG. 4) clear the lower bottom end surface 122 of the portable radiotelephone 100 (see FIG. 2), at step 802. As the optional battery pack 102 is pulled downward, the latch 162 is extended from the rest position 646 releasing the button 642 of the switch 632 (see FIG. 6). Once released, the plurality of electrochemical cells 636 are coupled to the set of projecting contacts 422. The optional battery pack 102 is pulled downward until the latch 162 is in the engaging/disengaging position 650.

At step 804, the optional battery pack 102 is maintained in the engaging/disengaging position and rotated about the hooked end 404 and angled back until the front surface 146 of the optional battery pack 102 (FIG. 4) is in juxtaposition with the rear surface 120 of the portable radiotelephone 100 (FIG. 2). Once juxtaposed, the set of projecting contacts 422 of the optional battery pack 102 depress and electrically contact a lower portion of the set of flat contacts 208 of the portable radiotelephone 100. With the switch 632 already released, the plurality of electrochemical cells 636 provide power to the portable radiotelephone 100 via the electrical connection of the set of projecting contacts 422 and the set of flat contacts 208. The cylindrical prongs 420 of the latching mechanism 160 are aligned directly beneath the corresponding right and left receptacles 300, 302 (see FIG.

3) of the optional battery pack retaining device 123 of the portable radiotelephone 100.

Attachment of the optional battery pack 102 to the portable radiotelephone 100 becomes complete with the execution of step 806, which denotes release of the optional battery pack 102 so as to allow the optional battery pack 102 to move upward and cause the cylindrical prongs 420 to insert into the right and left receptacles 300, 302 and the right and left ramped top surfaces 416, 418 (see FIG. 4) to abut the lower bottom end surface 122 of the portable radiotelephone 100. With release, the set of projecting contacts 422 remain depressed and in electrical contact with the set of flat contacts 208 as they move to reside in an upper portion of the set of flat contacts 208 (see FIG. 7). Once attached, the latch 162 resides in the engaged position 648 (see FIGS. 6 and 7).

Detachment of the optional battery pack 102 from the portable radiotelephone 100 is illustrated by substantially reversing the order of the aforementioned steps 800-806. To accomplish detachment, the optional battery pack 102 is first pulled downward until the cylindrical prongs 420 are completely removed from the right and left receptacles 300, 302 and the latch 162 moves from the engaged position 648 to the engaging/disengaging position 650; the optional battery pack 102, while maintained in the engaging/disengaging position 650, is next rotated about the hooked end 404 so as to remove the front surface 146 from its juxtaposition with the rear surface 120 of the portable radiotelephone 100 and remove the set of projecting contacts 422 from electrical contact with the set of flat contacts 208; and, finally, the optional battery pack 102 is released thereby permitting removal of the hooked end 404 from the notch 206 and retraction of the latch 162 from the engaging/disengaging position 650 to the rest position 646. Once retracted to the rest position 646, the button 642 of the switch 632 is once again depressed thereby causing the plurality of electrochemical cells 636 to become disconnected from the set of projecting contacts 422.

FIG. 9 illustrates the portable radiotelephone 100 having the optional battery pack 102 attached thereto and an associated accessory. Aside from latching the optional battery pack 102 to the portable radiotelephone 100, the latch 162 includes the receptacle 402 (see FIG. 4) to allow attachment of the portable radiotelephone 100 into an accessory, such as a hang-up cup, while the optional battery pack 102 is attached to the portable radiotelephone 100. In FIG. 9, the portable radiotelephone 100 with the optional battery pack 102 attached thereto is positioned above a hang-up cup 900. The hang-up cup 900 includes a front surface 902 having a top side 904, a right side 906, a bottom side 908, and a left side 910 extending rearward therefrom. The front surface 902 includes a recess 912 that is sized in accordance with the optional battery pack housing 144. The recess 912 includes a bottom surface 913 defining the depth thereof. A latch member 914 extends into the recess 912 from a top sidewall 918 of the recess 912 that extends opposite the top side 904 between the front surface 902 and the recessed surface 913. A button 916 that is depressible is biased to extend from a right opening 918 in the right side 906 of the hang-up cup 900. Upon depression of the button 916 into the right opening 920, the latch member 914 retracts into the top sidewall 918 from a latching position shown in FIG. 9. The hang-up cup 900 is typically mounted within the passenger compartment of a vehicle (not shown) and in close proximity to the operator of the vehicle to temporarily hold the portable radiotelephone 100 while it is not being used by the operator.

The portable radiotelephone 100 with the optional battery pack 102 attached thereto is attached to the hang-up cup 900 by juxtaposing the rear surface 148 of the optional battery pack housing 144 and the recessed surface 913 of the hang-up cup 900 while depressing the button 916 and retracting the latch member 914. When the portable radiotelephone 100 with the optional battery pack 102 attached thereto is positioned in the recess 912, the button 916 is released causing the latch member 914 to engage the receptacle 402 of the latch 162 as telegraphed by dotted line 922. The portable radiotelephone 100 with the optional battery pack 102 attached thereto remains securely attached to the hang-up cup 900 until the user depresses the button 916 to retract the latch member 914 and lift the portable radiotelephone 100 with the optional battery pack 102 attached thereto away from the recess 912.

Turning now to FIGS. 10-14, the coupling of main battery pack 135 to the portable electronic device is shown. As shown in FIG. 10, the portable electronic device is in a closed position with main battery pack 135 detached. A recessed region 1002 for receiving the main battery pack comprises a first side wall 1004 and a second side wall 1006, and a rear wall 1008. A flange 1010 extends outward from the rear wall and over the recessed area. A second recessed area 1012 of upper rear surface 132 provides a flat surface for supporting an associated flange 1013 of main battery 135. A mating latch member 1013 comprises a recessed area 1014 having shoulders 1015 and 1016 adapted to receive latch member 212 to removably attach the main battery to the portable electronic device. When main battery 135 is inserted into recess 1002, a protrusion 1017 at a distal end 1018 of main battery 135 is adapted to be inserted below flange 1010.

As shown in FIG. 11, the inside and front walls of a recessed region for receiving the main battery pack includes contacts 1104-1110 which are adapted to mate with contacts 1202-1208 on the front surface of main battery pack 135 (FIG. 12). When main battery pack 135 is inserted into recess 1002, shoulders 1210 and 1212 are adapted to be inserted under shoulders 1015 and 1016. Edges 1020 and 1022 form a flush surface with side walls 1004 and 1006 respectively.

In summary, a latching mechanism disposed on an optional accessory, such as an optional battery pack, for attaching the optional battery pack to a portable electronic device, such as a portable radiotelephone, includes a support and a moveable latch that mate with first and second portions of a retaining device disposed on opposite ends of the portable radiotelephone. Because the retaining device is for an optional battery pack to supplement a main battery attached elsewhere on the portable radiotelephone, the retaining device should only minimally affect the appearance when the optional battery pack is not attached. The support includes a foot having a prong that is disposed on a first end of the optional battery pack and faces a hooked end of the moveable latch disposed on a second end of the optional battery pack. The moveable latch includes a spring disposed within the optional battery pack and coupled to the hooked end such that when the moveable latch is extended, the hooked end exerts a force on the first portion of the retaining device that draws the support into snug abutment with the second portion of the retaining device. The force, which is in a plane parallel to a front surface of the optional battery pack that extends between the ends thereof, maintains the optional battery pack in attachment with the portable radiotelephone allowing the optional battery pack to deliver power to the portable radiotelephone.

We claim:

1. A portable foldable radiotelephone comprising:

a first housing portion having first and second ends spaced by a first length;

a transceiver positioned in said first housing portion;

a second housing portion having first and second ends and first and second sides, said first and second ends of said second housing portion spaced by a second length substantially equal to the first length, said first and second sides of said second housing portion extending between said first and second ends of said second housing portion;

a hinge positioned at said second end of said first housing portion and at said second end of said second housing portion;

an inner wall positioned in said second housing portion to extend between said first and second sides of said second housing portion;

a speaker enclosure formed in said second housing portion, said speaker enclosure bounded by said first end of said second housing portion, said inner wall, said first and second sides of said second housing portion, a first surface of said second housing portion and a second surface of said second housing portion;

a speaker positioned in said speaker enclosure;

a recess formed in said second housing portion, said recess bounded by said first surface of said second housing portion, said first and second sides of said second housing portion, said inner wall and said second end of said second housing portion, said recess for receipt of a battery pack;

a mating latch member associated with said recess;

a first plurality of battery contacts associated with said recess; and

a battery pack adapted to be removably received in said recess, said battery pack having a latch member and a second plurality of battery contacts, said latch member to engage said mating latch member, and said second plurality of battery contacts to engage said first plurality of battery contacts.

2. A portable foldable radiotelephone according to claim 1 wherein

said mating latch member is formed on said inner wall, and

said latch member is carried on an end of said battery pack.

3. A portable foldable radiotelephone according to claim 2 wherein

said first plurality of battery contacts are carried in respective openings of said inner wall, and

said second plurality of battery contacts are carried on said end of said battery pack.

4. A portable foldable radiotelephone according to claim 3 wherein

said mating latch member is located at a center of said inner wall equidistant from said first and second sides of said second housing portion,

a first one of said first plurality of battery contacts is positioned between the center of said inner wall and said first side of said second housing portion, and

a second one of said first plurality of battery contacts is positioned between the center of said inner wall and said second side of said second housing portion, said first and second ones of said first plurality of battery contacts equidistant from the center.

15

5. A portable foldable radiotelephone according to claim 1 wherein
- said first plurality of battery contacts are carried in respective openings of said inner wall, and
 - said second plurality of battery contacts are carried on an end of said battery pack.
6. A portable foldable radiotelephone according to claim 5 wherein
- a first one of said first plurality of battery contacts is positioned between a center of said inner wall and said first side of said second housing portion, and
 - a second one of said first plurality of battery contacts is positioned between the center of said inner wall and said second side of said second housing portion, said first and second ones of said first plurality of battery contacts equidistant from the center.
7. A portable foldable radiotelephone comprising:
- a first housing portion having first and second ends spaced by a first length;
 - a transceiver positioned in said first housing portion;
 - a second housing portion having first and second ends and first and second sides, said first and second ends of said second housing portion spaced by a second length substantially equal to the first length, said first and second sides of said second housing portion extending between said first and second ends of said second housing portion;
 - a hinge positioned at said second end of said first housing portion and at said second end of said second housing portion;
 - an inner wall positioned in said second housing portion to extend between said first and second sides of said second housing portion;
 - a speaker positioned in said second housing portion between said first end of said second housing portion and said inner wall and between said first and second sides of said second housing portion;
 - a recess positioned in said second housing portion between said first and second sides of said second housing portion and between said inner wall and said second end of said second housing portion, said recess for receipt of a battery pack;
 - a mating latch member formed on said inner wall, said mating latch member comprising a recessed area;
 - a first plurality of battery contacts associated with said recess; and
 - a battery pack adapted to be removably received in said recess, said battery pack having a latch member and a second plurality of battery contacts, said latch member comprising a fixed portion, a lever arm, and a fulcrum joining said fixed portion to said lever arm, said fixed portion attached to an end of said battery pack, said lever arm movable under applied pressure in a direction towards said end of said battery pack, and said fulcrum biasing said lever arm in a direction away from said end of said battery pack, and, when said battery pack is removably received in said recess, said lever arm inserting into said recessed area to engage said latch member and mating latch member and said second plurality of battery contacts engaging said first plurality of battery contacts.
8. A portable foldable radiotelephone according to claim 7 wherein
- said recessed area further comprises first and second shoulders, said first shoulder of said recessed area

16

- positioned to extend from one side of said recessed area, said second shoulder of said recessed area positioned to extend from another side of said recessed area opposite said one side of said recessed area, and
 - said lever arm further comprises first and second shoulders, said first shoulder of said lever arm formed in one side of said lever arm, said second shoulder of said lever arm formed in another side of said lever arm opposite said one side of said lever arm, said first shoulder of said lever arm to insert under said first shoulder of said recessed area when said battery pack is removably received in said recess, and said second shoulder of said lever arm to insert under said second shoulder of said recessed area when said battery pack is removably received in said recess.
9. A portable foldable radiotelephone according to claim 7 wherein
- said first plurality of battery contacts are carried in respective openings of said inner wall, and
 - said second plurality of battery contacts are carried on said end of said battery pack.
10. A portable foldable radiotelephone according to claim 9 wherein
- said mating latch member is located at a center of said inner wall equidistant from said first and second sides of said second housing portion,
 - a first one of said first plurality of battery contacts is positioned between the center of said inner wall and said first side of said second housing portion, and
 - a second one of said first plurality of battery contacts is positioned between the center of said inner wall and said second side of said second housing portion, said first and second ones of said first plurality of battery contacts equidistant from the center.
11. A portable foldable radiotelephone comprising:
- a first housing portion having first and second ends spaced by a first length;
 - a transceiver positioned in said first housing portion;
 - a second housing portion having first and second ends, first and second sides, and first and second surfaces, said first and second ends of said second housing portion spaced by a second length substantially equal to the first length, said first and second sides of said second housing portion extending between said first and second ends of said second housing portion, said first surface of said second housing portion extending from said first end of said second housing portion and between said first and second sides of said second housing portion, and said second surface extending between said first and second ends of said second housing portion and between said first and second sides of said second housing portion;
 - a hinge positioned at said second end of said first housing portion and at said second end of said second housing portion;
 - an inner wall extending between said first and second sides of said second housing portion and between said first and second surfaces of said second housing portion;
 - a speaker enclosure formed in said second housing portion, said speaker enclosure bounded by said first end of said second housing portion, said inner wall, said first and second sides of said second housing portion, said first surface of said second housing portion and said second surface of said second housing portion;

17

- a speaker positioned in said speaker enclosure;
- a recess formed in said second housing portion, said recess bounded by said first surface of said second housing portion, said first and second sides of said second housing portion, said inner wall and said second end of said second housing portion, said recess for receipt of a battery pack;
- a mating latch member formed on said inner wall to face said recess, said mating latch member comprising a recessed area having first and second shoulders extending therefrom;
- a first plurality of battery contacts carried in respective openings of said inner wall and facing said recess, a first one of said first plurality of battery contacts positioned between said recessed area of said mating latch member and said first side of said second housing portion, a second one of said first plurality of battery contacts positioned between said recessed area of said mating latch member and said second side of said second housing portion; and
- a battery pack adapted to be removably received in said recess, said battery pack comprising first and second ends, first and second surfaces, first and second sides extending between said first and second ends of said

18

battery pack and spaced apart by said first and second surfaces of said battery pack, a second plurality of battery contacts carried on said first end of said battery pack, and a latch member carried on said first end of said battery pack, said latch member comprising a movable lever arm having first and second shoulders formed in sides thereof, and

wherein, upon reception of said battery pack in said recess, said first end of said battery pack juxtaposes said inner wall, said first and second shoulders of said lever arm insert under respective ones of said first and second shoulders of said recessed area to thereby mate said latch member and mating latch member, said first plurality of battery contacts mate with said second plurality of battery contacts, said first surface of said battery pack joins flush said first surface of said second housing portion to form a continuous surface, at least a portion of said first side of said battery pack joins flush said first side of said second housing portion to form a continuous surface, and at least a portion of said second side of said battery pack joins flush said second side of said second housing portion to form a continuous surface.

* * * * *



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Suso et al.

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(45) **Date of Patent:** Oct. 15, 2002

(54) **INFORMATION TERMINAL UNIT**

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(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(52) **U.S. Cl.** 345/169; 345/158; 345/173; 455/556; 455/566

(58) **Field of Search** 345/1.1, 1.3, 2.3, 345/3.1, 4, 5, 87, 88, 901, 156, 168, 169, 158, 173, 864, 902, 903; 348/14.02, 14.03; 379/433.02-433.04; 455/556, 566, 557, 575

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Assistant Examiner—Jeff Piziali

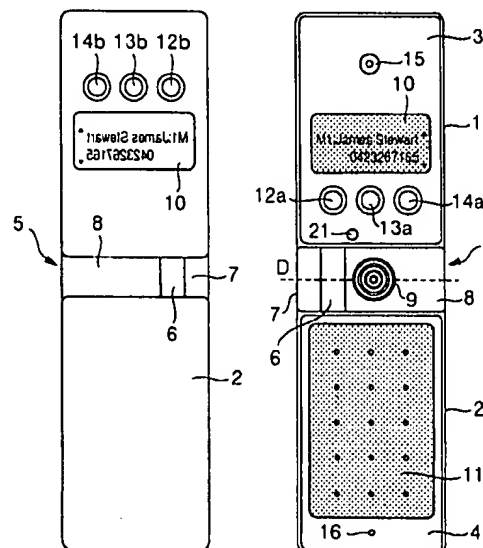
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(57)

ABSTRACT

A portable information terminal unit comprises a first and a second casing, a hinge means for coupling the first and second casing so that the first and second casing are rotatable relative to each other, an opening piercing through the first casing, a first see-through liquid crystal display part fitted in the opening, a means for detecting opening of the first and second casing, relative to each other, and a control means for reversing a display on the first see-through liquid crystal display part in response to a detection by the detecting means, wherein monochromatic information is displayed on the first see-through liquid crystal display part so as to reduce power consumption.

10 Claims, 8 Drawing Sheets



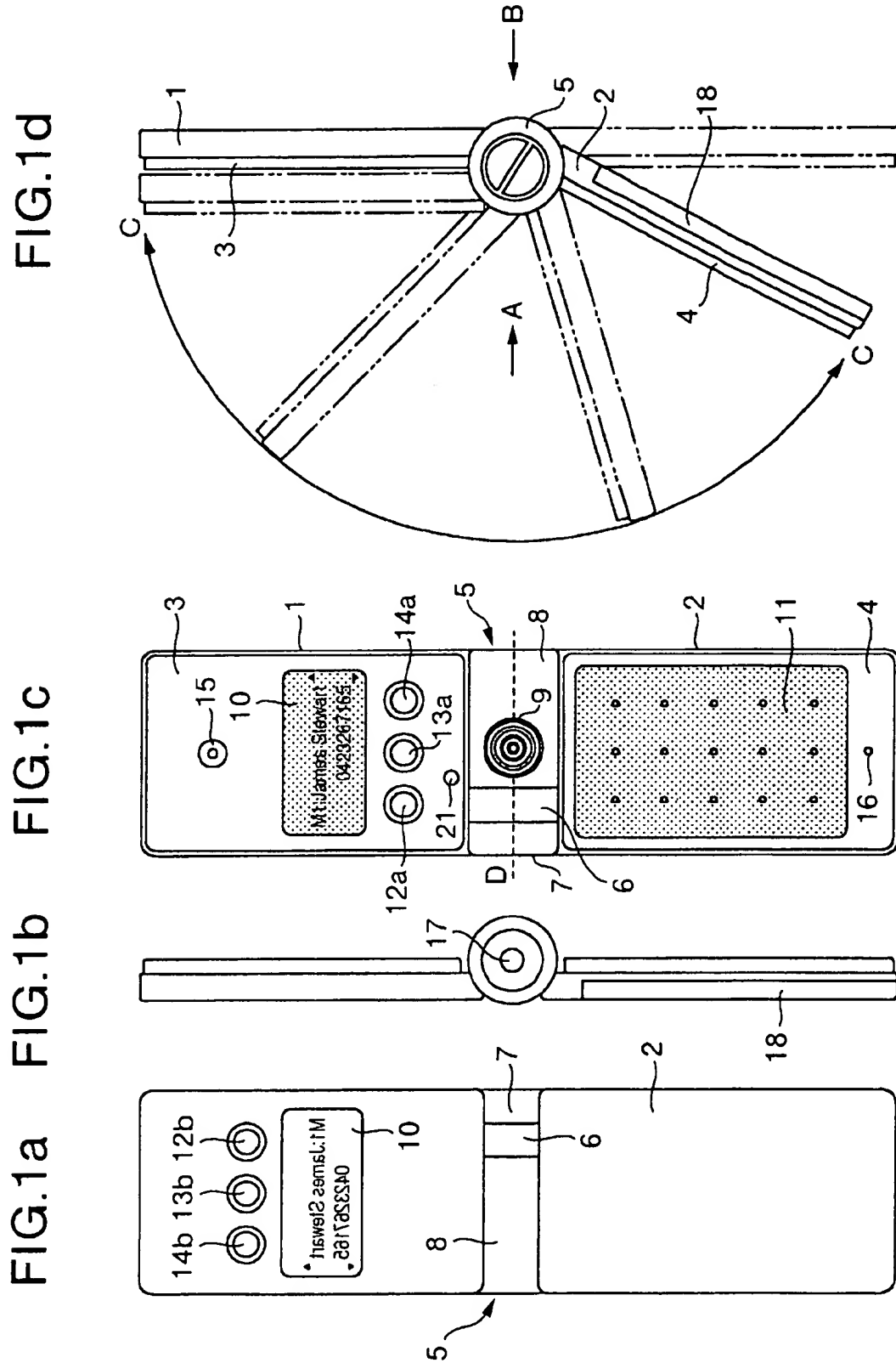


FIG.2a

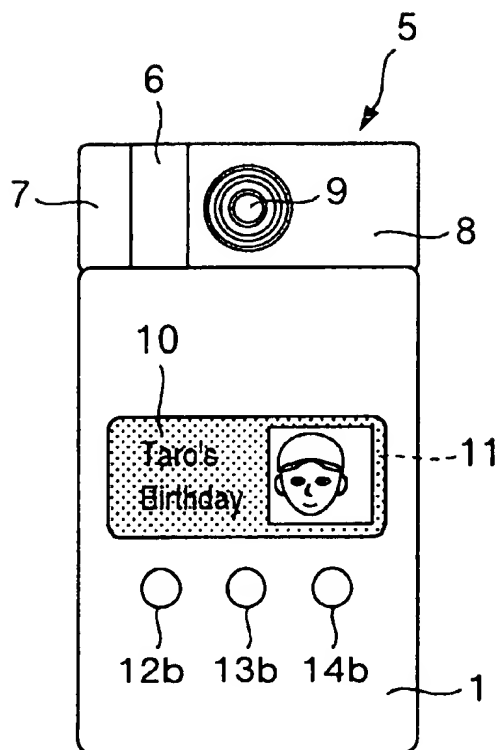


FIG.2b

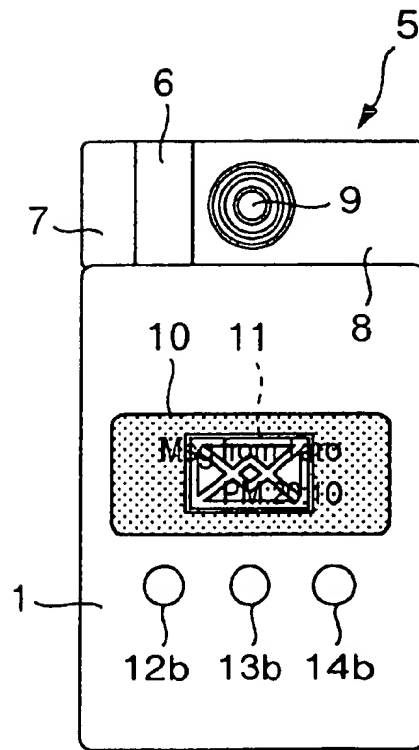


FIG. 3a

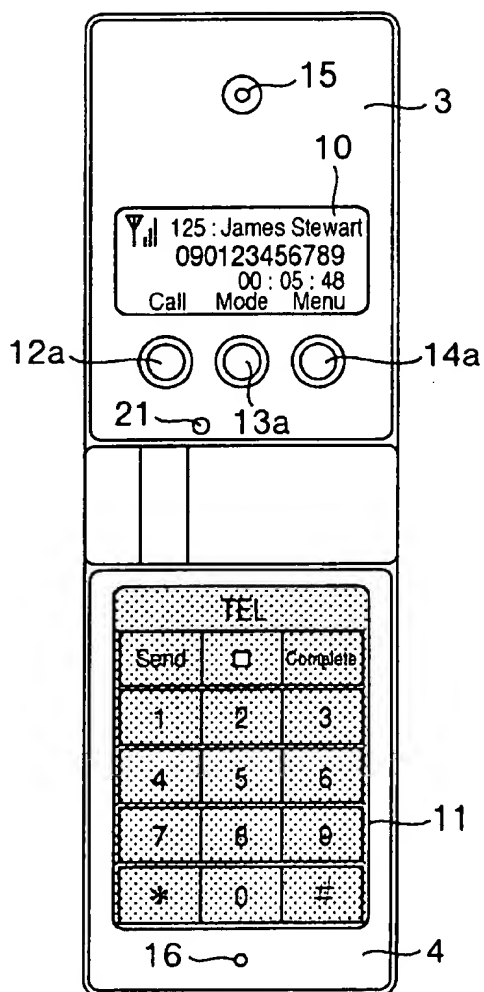


FIG. 3b

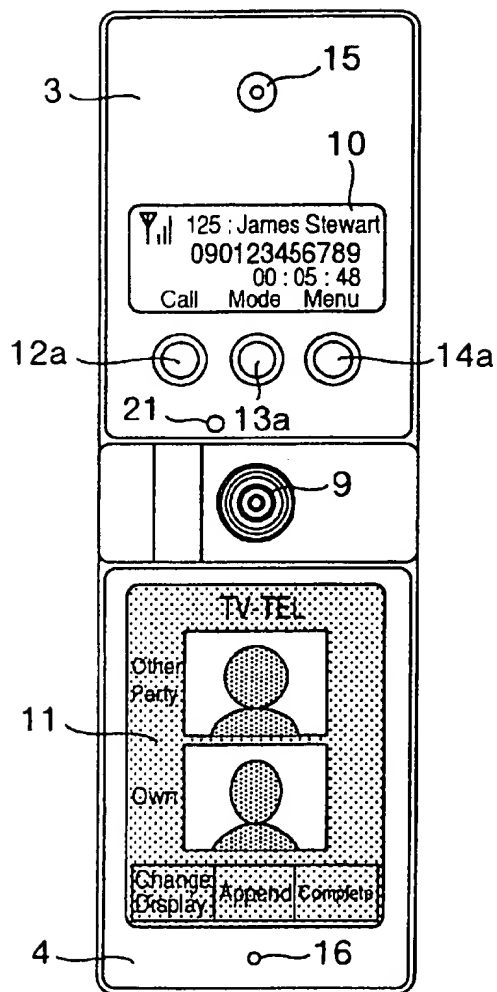


FIG. 4

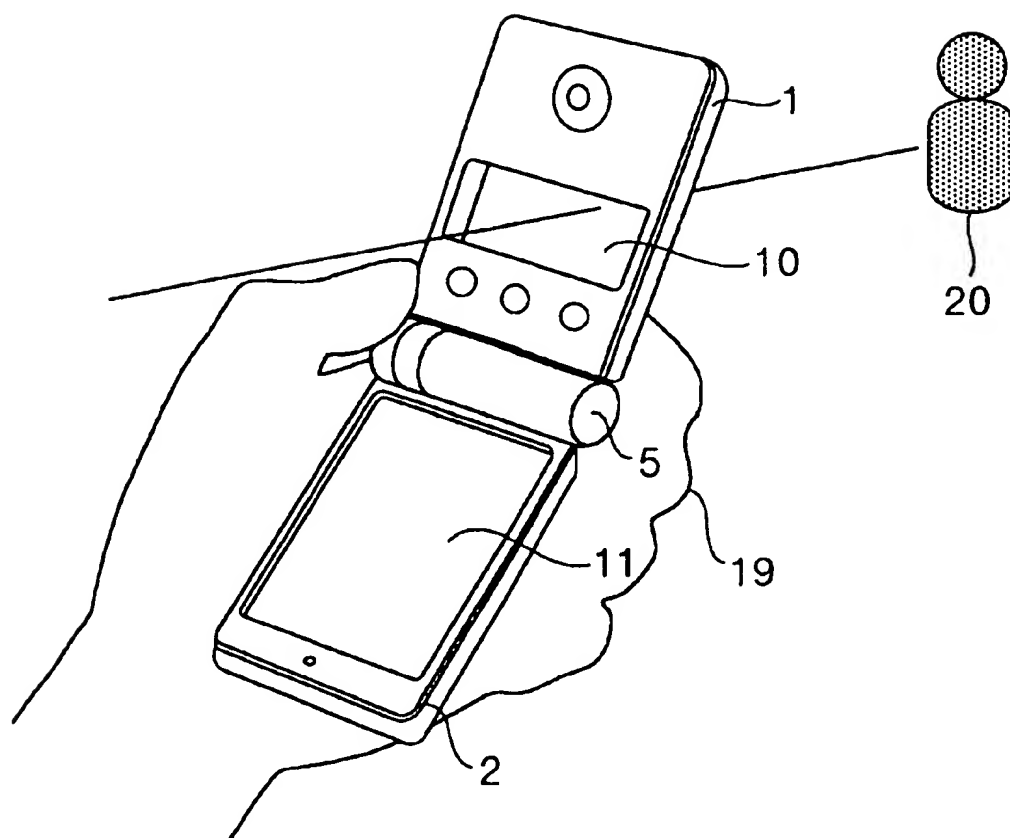


FIG. 5a

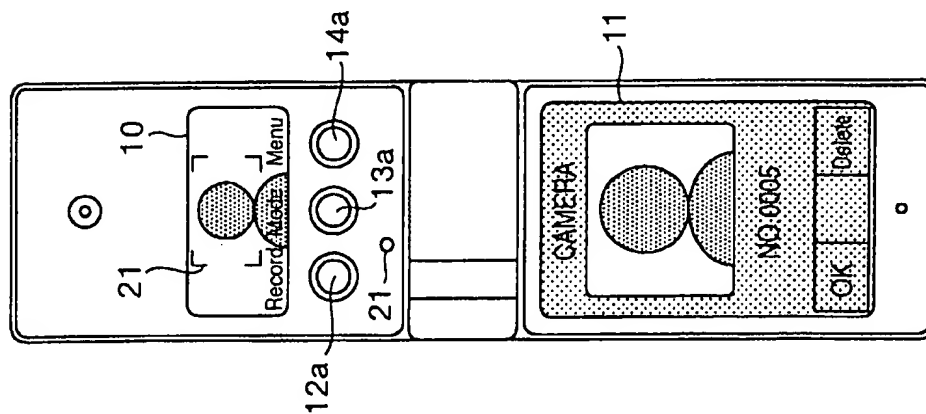


FIG. 5b

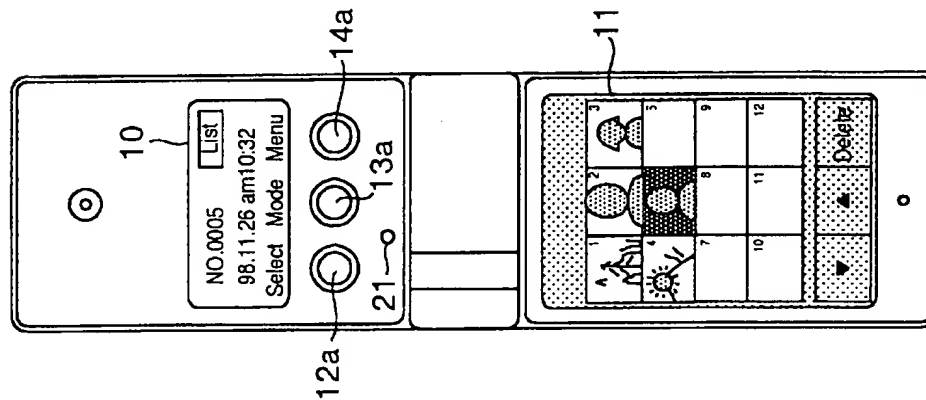


FIG. 5c

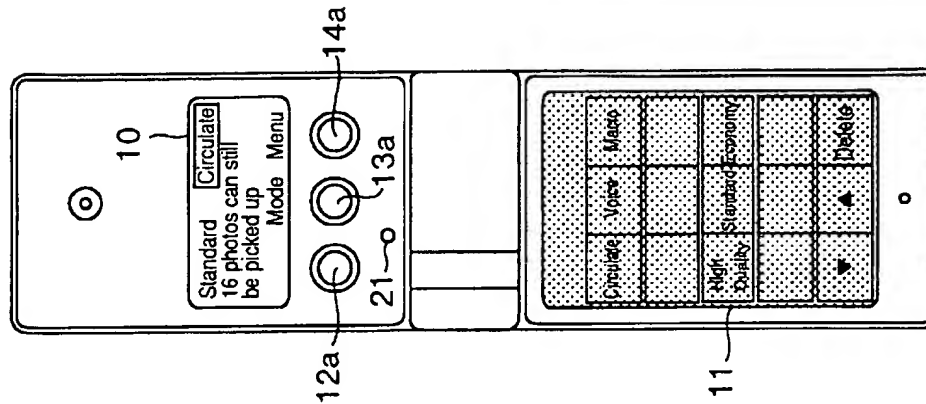


FIG. 6b

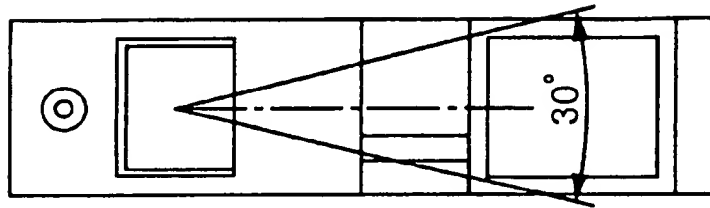


FIG. 6a

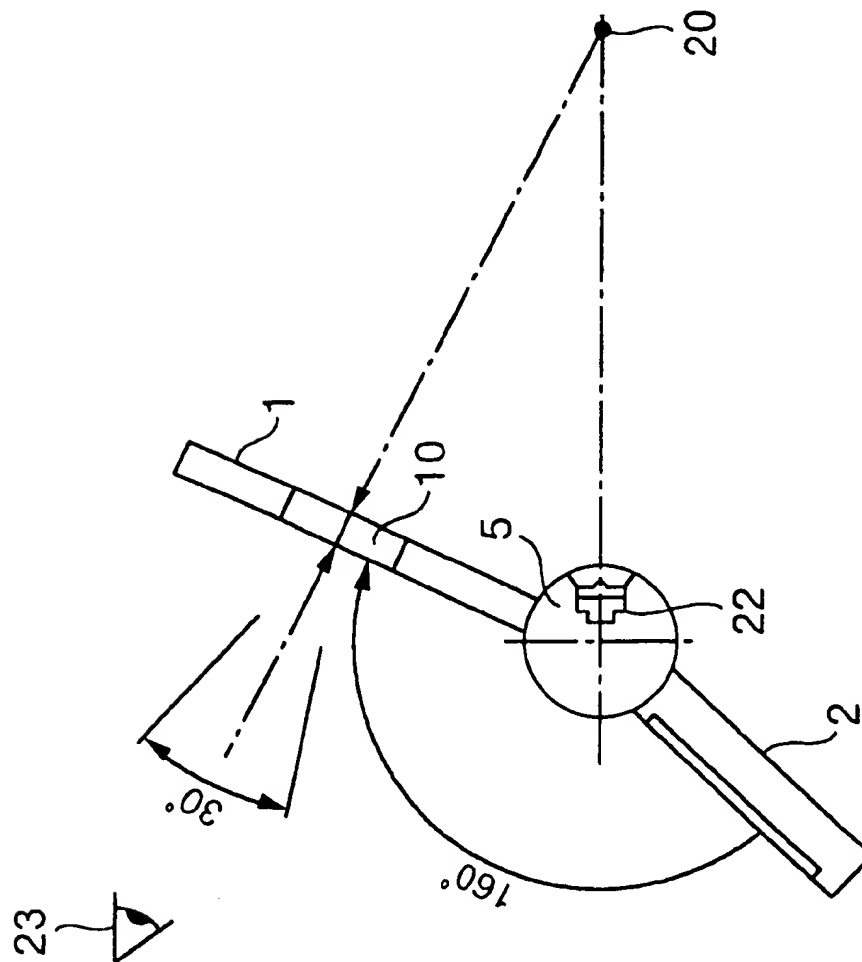


FIG. 7a

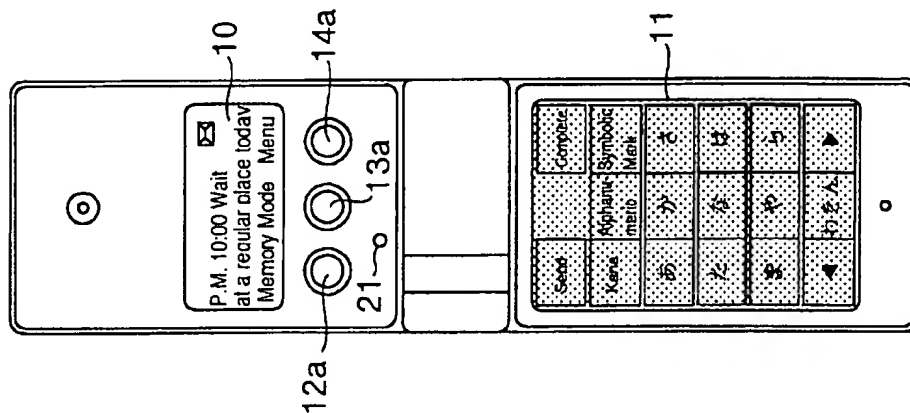


FIG. 7b

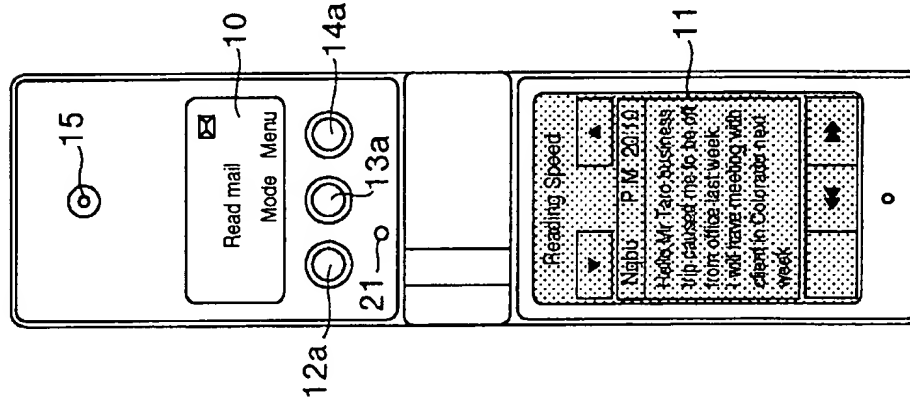


FIG. 7c

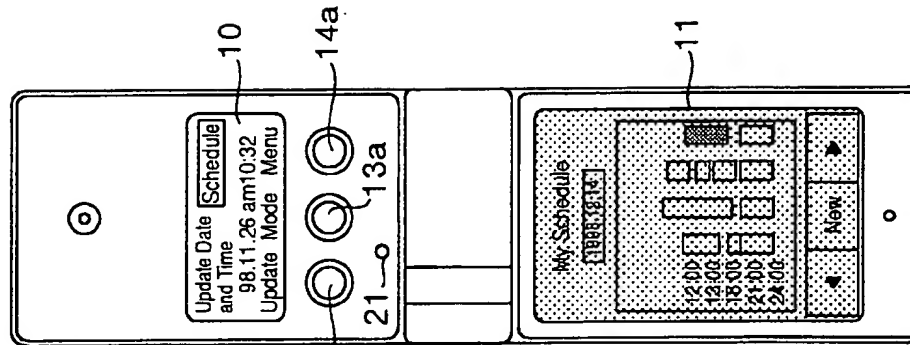


FIG. 8a

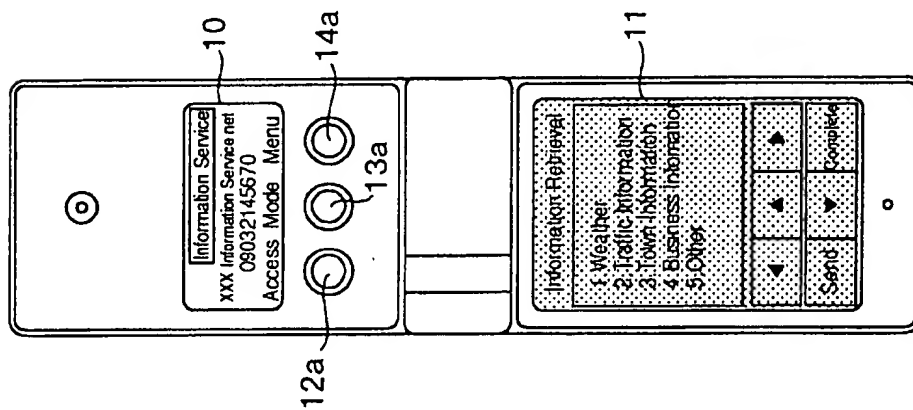


FIG. 8b

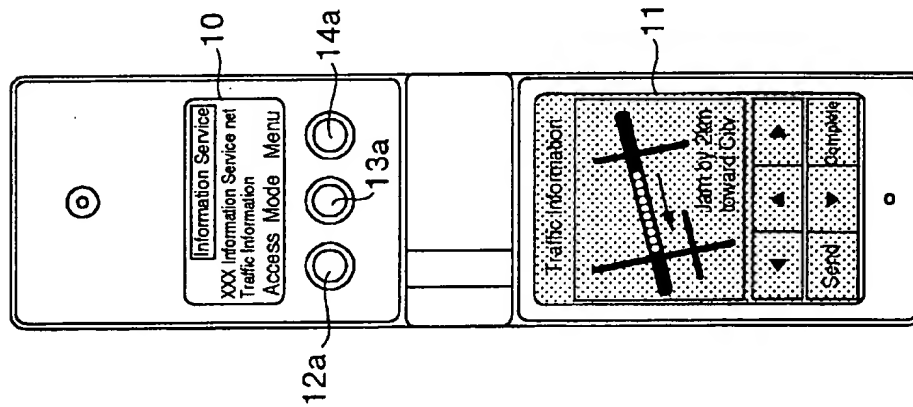
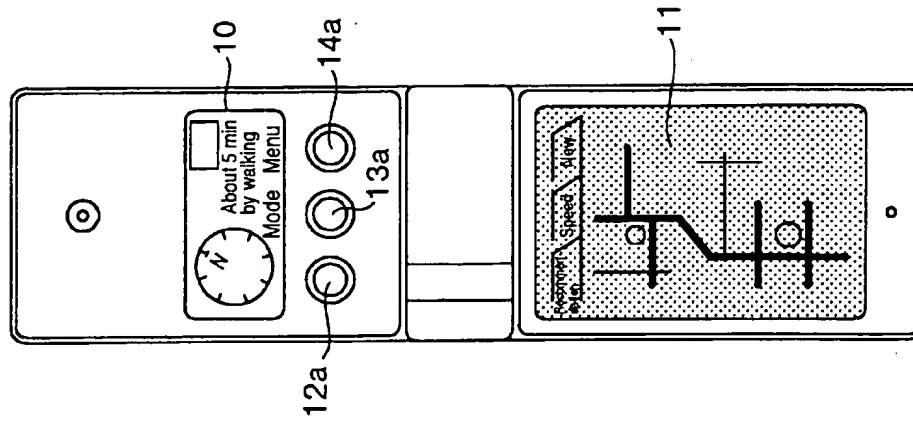


FIG. 8c



1

INFORMATION TERMINAL UNIT

BACKGROUND OF THE INVENTION

The present invention related to an information terminal unit, and in particular, to a portable information terminal unit of a foldable note-book type, having a plurality of functions.

As portable personal information terminal units, these days, there have been prosperously used electronic notes, electronic dictionaries, portable televisions, minidisk units, portable information communication units such as mobile terminal units including portable telephones which can transmit and receive information signals at remote positions.

Portable terminal units (PDA) have been known as portable information communication terminal units, which incorporate a transmitting and receiving function capable of transmitting and receiving image data, and among these portable information communication terminal units, the one is coupled to a portable telephone, that is, it can be separated from the latter, and the one is integrally incorporated with a portable telephone. These portable information communication terminal unit can transmit and receive not only image data but also voice data when it is used as a telephone.

In general, a notebook type portable information terminal unit is composed of two panels hinged to each other, and in use, after the panels are opened, a liquid crystal display unit provided on the inside of one of the panels is observed while keys or switches provided on the inside of the other one of the panels are manipulated. However, with the portable information terminal unit of this type, the liquid crystal display unit cannot be observed if the two panels are closed, and accordingly, a necessary minimum volume of information such as a power consumption of a battery for driving the information terminal unit or the present condition of information communication thereof cannot hardly be known from the outside thereof.

Further, portable information communication terminal units which carry out collection, processing, and transmission and reception of data as its main objects, at a destination and which can transmit and receive color image data have been more and more prosperous, and are now used in combination with a portable telephone so as to enable communication of both color image data and voice data. Some of them are used for talking with the other person while confirming the face of the other person. However, the portable information communication terminal units as mentioned above, are relatively bulky, and accordingly, are less portability.

Further, in such an arrangement that a portable terminal unit is used with a portable telephone, both portable terminal unit and telephone should be carried, and accordingly, the portability thereof is still less.

Accordingly, the applicant proposed, in order to solve the above-mentioned problems, an information communication terminal unit, as disclosed in Japanese Laid-Open Patent No. H9-226800, which comprises an upper and a lower casing which are rotatably attached to each other through the intermediary of a coupling part, liquid crystal display parts provided respectively on the upper and lower casing, on which image data and a touch panel are displayed, respectively, and a video-camera accommodated in the coupling part, the video-camera being rotatable, independent from the casings, so as to allow the video-camera to freely change its direction.

However, the above-mentioned information communication terminal unit has relatively high power consumption

2

since two large size liquid crystal display parts are incorporated therein. Since this portable information communication terminal unit usually uses a battery as a power source, it is desirable to minimize power consumption as far as possible. Further, when information is received even on carrying of the portable information communication terminal unit, it cannot be confirmed unless the casings are opened in order to observe the content of the information displayed on the liquid crystal display part after the portable communication terminal unit is taken up. In view of the this fact, it has been desirable to confirm the content of information at one glance without opening the casings.

The present invention is devised in view of the above-mentioned problems, and accordingly, an object of the present invention is to provide a multi-functional information communication terminal unit which is excellent in portability, which can reduce the power consumption so as to be convenient in use.

SUMMARY OF THE INVENTION

To the end, according to a first aspect of the present invention, there is provided a portable information terminal unit comprising a first and a second casing, a hinge means coupling the first and second casings with each other so that the first and second casing are relatively rotatable with respect to each other, an opening piercing through the first casing, a see-through first liquid crystal display part fitted in the opening, and a manipulation part incorporated in the second casing, a means for detecting an opening of the first and second casing, a control means for reversing a display on the see-through first liquid crystal display part in response to a detection by the detecting means.

According to the second aspect of the present invention, there is provided a portable information terminal unit comprising a first and second casings, a hinge means for coupling the first and second casing with each other so that the first and second casing are relatively rotatable with respect to each other, an opening piercing through the first casing, a see-through first liquid crystal display part fitted in the opening, and a second liquid crystal display part provided in the second casing, a means for detecting an opening of the first and second casings, and a control means for reversing a display on the see-through first liquid crystal display part in response to a detection by the detecting means.

According to a specific embodiment of the second aspect of the present invention, the first and second casing are set in such a relationship that the see-through first liquid crystal display part is superposed with the second liquid crystal display part at least in part of the latter when the first and second casing are closed being mated with each other.

With this arrangement, even though the first and second casing are closed being superposed with each other, information displayed on the see-through first liquid crystal part can be observed from the outside. Further, information displayed on the second liquid crystal display part can be observed through the see-through first liquid crystal display part. Thus, it is possible to eliminate the necessity of opening the casings in order to confirm the content of the information. Further, a small-sized liquid crystal display panel is used in the see-through first liquid crystal display part, and accordingly, no relatively high power is required for a display on the see-through liquid crystal display part.

Further, according to another specific embodiment of the second aspect of the present invention, the see-through first liquid crystal display part is monochromatic, and the second liquid crystal display part is multicolored.

3

In this specific embodiment, a large-sized high power consumption multi-colored liquid crystal display part is provided on one of the casings, and a small-sized lower power consumption monochromatic liquid display part is provided on the other one of the casings, and accordingly, information which can be monochromatically displayed is displayed on the see-through liquid crystal display part without using the multicolored liquid crystal display part, thereby it is possible to reduce the power consumption. Further, even though the casings are superposed with each other, that is, are closed, the multicolored liquid crystal display part can be observed through the see-through liquid crystal display part, thereby it is possible to observe not only an information displayed on the see-through liquid crystal display part but also an information displayed on the multi-colored liquid crystal display part.

Further, according to another specific form of the second aspect of the present invention, a video camera is incorporated in the above-mentioned coupling part so as to be rotatable, independent from the first and second casing, and accordingly, the direction of the video-camera can be freely changed. According to the present invention, since the video-camera whose direction can be freely changed, is provided, an image from an object located in an arbitrary direction can be picked up, irrespective of the opening or closing of the above-mentioned casings. Further, during pick-up of an image, if the first and second casing are opened, the above-mentioned see-through liquid crystal display panel can be used as a finder for the video-camera, thereby it is possible to enhance the convenience thereof in use.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1a to 1d are views illustrating a portable information communication terminal unit in the form of a preferable embodiment of the present invention, among those, FIG. 1a is a rear view, FIG. 1b is a side view, FIG. 1c is a front view and FIG. 1d is a side view in which the portable information communication terminal unit is opened at an arbitrary angle;

FIGS. 2a to 2c are front views illustrating the portable information communication terminal unit shown in FIG. 1a, in different display conditions;

FIGS. 3a and 3b are front views illustrating the portable information communication terminal unit shown in FIG. 1a, in such a condition that it is used in different operation modes;

FIG. 4 is a view illustrating the portable information communication terminal unit shown in FIG. 1a, in such a condition in which it is used as a camera;

FIGS. 5a to 5c are views illustrating the portable information communication terminal unit shown in FIG. 1a, in such a condition that it is used as camera in different operation modes;

FIGS. 6a and 6b are a side and a front view for explaining a finder function of a see-through liquid crystal display part in the portable information communication terminal unit shown in FIG. 1a, in the camera mode shown in FIG. 5a;

FIG. 7a to 7c are front views illustrating the portable information communication terminal unit shown in FIG. 1a, in such a condition that it is used as a smart phone in different operation modes; and

FIGS. 8a to 8c are front views illustrating the portable information communication terminal unit shown in FIG. 1a, which is used as a navigation device in such a condition that it is used in different operation modes.

4

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Detailed explanation will be made of an embodiment of the present invention with reference to the drawings.

Referring to FIGS. 1a to 1d which show an embodiment of a portable information and communication terminal unit according to the present invention, there are shown outer casings 1, 2, inner casings 3, 4, a coupling part 5, a rotary shaft support part 6, a rotary shaft 7, an accommodation member 8, a camera lens 9, a see-through liquid crystal display part 10, a multicolored liquid crystal display part 11, manipulation keys 12a, 12b, 13a, 13b, 14a, 14b, a speaker 15, a microphone 16, a power source switch 17, a battery accommodation part 18 and an opening and closing detecting switch 21.

At first, specifically referring to FIGS. 1a to 1d, the rotary shaft 7 provided to the outer casing 1 and the rotary support part 6 provided to the outer casing 2 constitute a hinge structure, and accordingly, the outer casings 1, 2 can be opened and closed as a notebook, as indicated by the arrow C in FIG. 1d. Further, the rotary shaft support part 6 is rotatably attached on the side remote from the rotary shaft 7, with the accommodation member 8 in which a thin video camera and a circuit board mounted thereon with a circuit for processing output signals from the video camera are accommodated. Further, the accommodation member 8 is formed in a part thereof with a hole in which the camera lens 9 is fitted. As clearly understood from FIGS. 1a to 1d, there are presented no parts projecting from the accommodation member 8.

Further, the outer casing 1 is mounted thereon with the inner casing 3 while the outer casing 2 is mounted thereon with the inner casing 4, and on the outer casing 1 side, an opening is formed having a small area and piercing through the outer casing 1 and the inner casing. A see-through liquid crystal display part 10 is fitted in the opening. A multicolored liquid crystal display part 11 having a large area is mounted on the inner casing 4. In the see-through liquid crystal display part 10, transparent liquid crystal is used, and accordingly, through this see-through liquid crystal display part 10, the front side can be seen from the rear side as shown in FIG. 1a, and the rear side can be seen from the front side as shown in FIG. 1c.

The manipulation keys 12a, 13a, 14a are provided on the front surface of the inner casing 3, for example, at positions below the see-through liquid crystal display part 10, and the manipulation keys 12b, 13b, 14b respectively having the same functions as those of the manipulation keys 12a, 13a, 14a are provided on the outer surface of the outer casing 1 at positions above the see-through liquid crystal display part 10. These manipulation keys 12b, 13b, 14b are adapted to be manipulated so as to perform the same functions as those of the manipulation keys 12a, 13a, 14a when the outer casings 1, 2 are closed. As shown in FIGS. 2a and 2b, when the outer casings 1, 2 are closed, the manipulation keys 12b, 13b, 14b respectively corresponding to the manipulation keys 12a, 13a, 14a are located with respect to the see-through liquid crystal display part 10 in a relationship similar to that of the manipulation keys 12a, 13a, 14a with respect to the see-through liquid crystal display part 10 when the outer casings 1, 2 are opened, as shown in FIG. 1c.

It is noted that operating functions of the manipulation keys 12a, 13a, 14a are displayed on the see-through liquid crystal display part 10 in the vicinity of the keys 12a, 13a, 14a, respectively, and accordingly, these keys 12a, 13a, 14a can be used as multifunctional keys for various purposes.

5

Further, as shown in FIG. 1c, the speaker 15 (or an earphone jack) is provided in the inner casing 3 above the see-through liquid crystal display part 10, and a microphone 16 is provided in the inner casing 4 below the multicolored liquid display part 11. Further, the rotary shaft 7 is provided with the power source switch 17, and the outer casing 2 is provided with the battery accommodation part 18 in which a battery for driving the information communication terminal unit is accommodated.

Although it is not shown, an extendable antenna is provided so that communication can be made with a remote station through this antenna.

A multi-colored liquid crystal display part 11 can display data or an image such as an image picked up by the video-camera accommodated in the coupling part 5, still images or animation stored in memory provided in the inner casing 4, or information such as a sentence consisting of characters. Further, the see-through liquid crystal display part 10 can display information such as strings of characters or marks which can indicate a charged condition of the battery, a present status of this portable information communication terminal unit, such as information as to whether a signal is received or not on the portable information communication terminal unit, and the like. Further, this see-through liquid crystal display part 10 can display a simple sentence.

A multi-colored liquid crystal display panel having a high degree of definition is used in the multicolored liquid crystal display part 11 in order to obtain high quality multicolored display images. When an image is displayed on such a multi-colored liquid crystal display part 11, a CPU incorporated in the inner casing 4 controls the display of the image with the use of a frame memory. Accordingly, a content stored in the frame memory is displayed on the multicolored liquid crystal display part. In the case of displaying animations or even strings of characters, that is, sentences, on the multi-colored liquid crystal display part, if contents to be displayed are changed by scrolling or the like, the CPU rewrites a content in the frame memory each when the contents to be displayed are changed. Further, this frame memory has a large capacity so as to require a relatively large power, and accordingly, when an image such as an animation whose content varies is displayed on the multi-colored liquid crystal display part 11, the power consumption becomes large, resulting in occurrence of unpreferable problems if a battery is used as its power source.

In order to eliminate the above-mentioned problems, in this embodiment, an inexpensive see-through liquid crystal display part 10 having a lower power consumption is used, and accordingly, a present status of the portable information communication terminal unit or a short sentence is displayed on this see-through liquid crystal display part. In this case, by turning on the power source switch 7 so as to energize the information communication terminal unit, a string of characters or a mark indicating a condition of the battery is displayed on the see-through liquid crystal display part. Further, when signals are received, the contents of the signals are displayed on the see-through liquid crystal display part, instead of the information having the content of the condition of the battery.

This see-through liquid crystal is small-sized, and is adapted to monochromatically display characters thereon. Thus, the capacity of memory used in this indication becomes less, and accordingly, the power consumption thereof can become extremely low. The information indicating the present status of the information communication terminal unit may be displayed in an extremely small area,

6

and accordingly, even though signals are frequently received so that the memory should be frequently rewritten in order to display the contents thereof on the see-through liquid crystal display part 10, the power consumption does not become extremely large. Further, even the information with which a condition of the battery is indicated, varies only when the charged voltage remaining in the battery becomes abnormally lower, and accordingly, the information is substantially displayed in the form of a still image. Thereby it is possible to further lower the power for displaying the information on the see-through liquid crystal display part 10.

The rotary shaft 7 which is rotatably attached to the rotary shaft support part 6 is fitted thereon with the accommodation member 8 which is therefore rotatable around the center axis D of the rotary shaft 7. When the accommodation member 8 is rotated by finger tips or the like, relative to the rotary shaft 7, the direction of the video camera accommodated in the accommodation member 8, that is, the direction of the camera lens 9 can be changed over an angle of 360 deg. around the center axis D of the rotary shaft 7.

Referring to FIGS. 2a and 2b, which show the casings 1, 2 in this embodiment, in such a condition that they are closed, the see-through liquid crystal display part is superposed in its entirety with a part of the multi-colored liquid crystal display part 10 shown in FIG. 1c. That is, with this arrangement in which the see-through liquid crystal display part 10 is fitted on the outer casing side, the part of the multicolored liquid crystal display part 11 can be observed through the see-through liquid crystal display part 10.

Thus, whenever a mail is received even though the casings 1, 2 are closed, the indication informing that a signal has been received, that is, a mail address or a telephone number of a sender or a simple content of a mail is displayed on the see-through liquid crystal display part 10, and further, in such a case that an image is transmitted together with the mail, this image is displayed on the multi-colored liquid crystal display part 11 so as to be visible through the see-through liquid crystal display part 10 as shown in FIG. 1c.

Referring to FIG. 2c, a simple content of a mail, that is, "Taro's birthday" is displayed on the see-through liquid crystal display part 10 while a photographic image is displayed on the multi-colored liquid crystal display part 11, which is preferably prevented from being superposed with the content of the mail indicated by a string of characters. Further, as shown in FIG. 2b, a simple content of a mail, that is, "Msg from Taro pm 20:10" is displayed on the see-through while a mail mark is displayed on the multicolored liquid crystal display part 11. In this case, the image can be easily recognized even though it is overlapped with the content of the mail.

Even though the casings 1, 2 are closed as mentioned above, the direction of the video-camera, that is, the direction of the camera lens 9 can be freely changed by rotating the accommodating member 8 by finger tips or the like.

In such a case that the information of indication displayed on the see-through liquid crystal display part 10 is observed while the casings 1, 2 are closed, in the direction as viewed in FIG. 2a, as clearly understood in FIG. 1a, the direction of the indication displayed on the see-through liquid crystal display part 10 is vertically reversed when it is observed outside of the outer casing 1 in such a case that the casings 1, 2 are opened. Accordingly, the direction of the information of the indication displayed on the see-through liquid crystal display part 10 should be automatically reversed when the casings 1, 2 are closed. Accordingly, the opening

7

and closing detecting switch 21 is provided, and the CPU incorporated in the portable information communication terminal unit controls the reversal of the information of the indication in accordance with an operation of the opening and closing detection switch 21.

In this embodiment, in the above-mentioned used conditions (functions), the used conditions can be further changed into any of a camera mode, a portable telephone mode or a smart phone. If the used conditions are changed from one to another, the manipulation keys 14a, 14b are used as change-over means. That is, they serve as function keys.

In this embodiment, as a certain mode, if the power switch 17 is turned on, the portable information communication unit can be automatically set into a portable telephone mode. Referring to FIG. 3a, a telephone sending mode in the used condition in which it is as a portable telephone, is shown. In this figure, like reference numerals are used to denote like parts to those in the figures mentioned before.

Referring to FIG. 3a, a telephone manipulation part in the form of a touch key board such as a ten key board is displayed on the multicolored liquid crystal display part 11 in this mode. When the keys on this key board are successively touched so as to enter a telephone number of the other party, the entered telephone number such as "090123456789" of the other party, and as well, the name "James Stewart" of the third party corresponding to the telephone number are displayed on the see-through liquid crystal display part 10 together with the present time or a time length of a telephone call. In this arrangement, after confirmation on the entry of the proper telephone number, a "sending" key displayed on the multicolored liquid crystal display part 11 is touched, calling for the other party can be carried.

It is noted that the manipulation key 12a serves as a call key which is used when an already registered telephone number is read out. After a response is received from the other party, if the third party uses a television telephone, the portable information communication terminal unit is automatically set in a television telephone mode as shown in FIG. 3b, but if the third party does not use the television telephone, the mode shown in FIG. 3a is held so as to enable telephone conversation. This telephone conversation is carried out through the microphone 16 and the speaker 15. When a "completion" key displayed on this multicolored liquid crystal display part 11 is touched, the telephone conversation is completed.

Further, when a mode key 13a is manipulated so as to shift the operation mode into a television telephone mode, an image from the other party is displayed on the multi-colored liquid crystal display part 11, as shown in FIG. 3b. Further, an image picked up by the video camera is displayed thereon, and accordingly, the direction of the video camera, that is, the direction of the camera lens 9 is turned to the user himself, an image picked up from the user can be displayed on the multicolored liquid crystal display part 11, and it is simultaneously sent to the other party.

In this television telephone mode, when the "completion" key displayed on the multicolored liquid crystal display part 11 is touched, the operation mode is returned into the telephone sending mode shown in FIG. 3a, and accordingly, the telephone conversation is completed. Further, each time when a "display change-over" key displayed on the multicolored liquid crystal display part 11 is touched, the display of images picked up from the other party and the user himself, the display of an image picked up from the other party, the display of an image picked from the user himself,

8

the display of images from the other party and the user himself as mentioned at first are successively selected in the mentioned order. It is noted that the display on the see-through liquid crystal display part 10 is the same as that in the case of the telephone sensing mode as shown in FIG. 3a.

It is noted, that when a signal is received from the third party in the telephone sending mode shown in FIG. 3a, the display explained with reference to FIGS. 1a to 2b is effected.

In this arrangement, each time when the manipulation key 14a which serves as a menu key is manipulated, the camera mode, the smart phone mode and the telephone sending mode and the camera mode first mentioned are successively selected in the mentioned order.

When the menu key 14a is manipulated in the portable telephone sending mode as shown in FIG. 3a, the operation mode is shifted into the camera mode. It is noted that the operation mode cannot be shifted during telephone conversation, and accordingly, even though the menu key 14a is manipulated in the television telephone mode as shown in FIG. 3b, the television telephone mode is still maintained.

Referring to FIG. 4 illustrating a using method in which the use condition is set in the camera mode, there are shown a human hand 1 and an object 20. In this figure, like reference numerals are used to denote like parts to those shown in the figures mentioned above.

Referring to this figure, in the case of this use condition, the portable information communication terminal unit is carried by the single human hand 19 after the outer casings 1, 2 are opened at a predetermined angle, and the video camera (which is not shown in this figure) provided in the coupling part 5 is directed to the object 20, and accordingly, an image can be picked from the object 20. In this case, no information is displayed on the see-through liquid crystal display part 10, and accordingly, the object 20 can be looked up through this see-through liquid crystal display part 10 which is transparent. An image picked up from the object 20 by the video camera is displayed on the multicolored liquid crystal display part 11.

FIGS. 5a to 5c show operation modes in such a used condition that the portable information communication terminal unit is used as a camera.

FIG. 5a shows an image pick-up mode in which the portable information communication terminal unit is used as shown in FIG. 4a. In this case, the see-through liquid crystal display part 10 serves as a finder of the camera. Accordingly, a telescopic display 21 used for providing a criteria to the image pick-up range can be made.

When this image pick-up mode is set, as shown in FIG. 6a, the casings 1, 2 are latched at a predetermined angle, for example, 160 deg. by means of a latch mechanism 22 provided in the coupling part 5, and an image is picked up in this condition. Further, there may be provided a filter (for example, an electronic filter or a sheet type filter) for limiting the viewing field on the outer surface of the see-through liquid crystal display part 10. Accordingly, as shown in FIG. 6a, the extent with which the object 20 can be seen through the see-through liquid crystal display part 10, is set, that is, for example, angles of \pm deg. with respect to a horizontal plane passing through the center of the see-through liquid crystal display part 10, as shown in FIG. 6a, and angles of \pm 15 deg. with respect to a vertical plane passing through the center of the see-through liquid crystal display part 10, as shown in FIG. 6b. Thus, if the eye 23 is deviated from this extent, the object 20 cannot be seen

through this see-through liquid crystal display part 10. With this limitation to the viewing field, the condition in which the object 20 is observed through the see-through liquid crystal display part 10 becomes always uniform, and accordingly, the see-through liquid crystal display part 10 can serve as a finder. That is, an image displayed on the multicolored liquid crystal display part 11 is in extend substantially corresponding to that within which the object can be observed through the see-through liquid crystal display part 10.

Referring to FIG. 5a, the manipulation key 12a serves as a recording key in this case.

Then this recording key 12a is manipulated, an picked-up image frame at this time is stored in the memory. Accordingly, each time when the recording key 12a is manipulated, images in respective frames are successively stored in the memory. In this case, the memory should have a large capacity. Thus, in this embodiment, the portable information communication terminal unit is connected to a server incorporating memory of a large capacity through radio communication, and accordingly, when the recording key 12a is manipulated, an image in a single frame is transmitted into the server and is stored in the memory at a predetermined address within the server. In this case, together with this image, data as to a number of the image and recording data are also recorded. For example, as shown in FIG. 5a, the number of the image is displayed with a number "No. 0005".

The manipulation key 13a also serves as a mode key for changing over the cameral mode. That is, each time when the manipulation key 13a is manipulated, a confirmation/search mode, a setting mode, an image pick-up mode and the confirmation/search mode mentioned at first are successively selected in the mentioned mode. In the image pick-up mode shown in FIG. 5a, when this mode key 13a is manipulated, the operation mode is shifted into the confirmation/search mode shown in FIG. 5b. In this confirmation/search mode, the images recorded as mentioned can be confirmed or searched for. When the change-over is made from FIG. 5a, at first as shown, the images stored up to the present time are displayed (in a thumb-nail list-up display). In this case, a designated image is displayed in a half-tone dot meshing, and simultaneously, by touching either one of a "▲" touch key and a "▼" touch key which are also displayed, the image to be designated can be changed. In such a case that all images cannot be displayed in this list-up display, either the "▲" touch key or the "▼" touch key is continuously touched so that the half-tone dot meshing is squeezed against the upper or lower edge of the list-up display in order to scroll the list-up display. Further, a number and a recording date of a designated image can be displayed on the see-through liquid crystal display part 10. Further, in this mode, the manipulation key 12a serves as a display change-over key.

As mentioned above, a desired image is designated by the half-tone dot meshing, and then the display change-over key 12 is manipulated, the above-mentioned designated image alone is displayed over the entire area in which the list-up display has been made on the multicolored liquid crystal display part 11. In such a image display, when the display change-over key 12 is manipulated, the original list-up display is again exhibited. Further, if a "delete" touch key displayed on the multicolored liquid crystal display part 10 in this list-up display exhibition is touched, a designated image in the list-up display is deleted. Thus, it is possible to an image which has been unnecessary can be deleted.

Thus, the confirmation of recorded images and the search therefor can be made. In this confirmation/search mode, if

the mode key 13a is manipulated, the operation mode is shifted into the setting mode shown in FIG. 5c. This setting mode is adapted to set a pick-up condition of the camera or the like, and accordingly, all set-up conditions are displayed, being listed up while the selected set-up condition is displayed by the half-tone dot meshing. Further, similar to the confirmation/search mode, the selected condition can be changed or the list-up display can be scrolled up by manipulating the "▲" touch key or the "▼" touch key.

Further, the content of a selected set condition and an additional information thereto are displayed on the see-through liquid crystal display part 10. In the condition as shown, the image quality is set to "standard", and in addition to this, an additional information indicating a number of images which can be stored in the memory, that is, for example, "Fifteen images can be still picked up" is displayed thereon.

In this setting mode, if the mode key 13a is manipulated, the operation mode is shifted into the image pick-up mode shown in FIG. 5a. Accordingly, before an image is picked up, the setting mode shown in FIG. 5c is effected by manipulating the mode key 13a, and a predetermined pickup condition is set up. Accordingly, an image can be picked up in a predetermined condition. Further, by setting the setting mode shown in FIG. 5c, the number of images which can be stored in the memory can be known. Further, after the confirmation/search mode is set, an necessary stored image can be deleted by manipulating the "▲" touch key or the "▼" touch key and the "delete" touch key. Further, a stored image can be edited after the images are stored.

In a camera using condition shown in FIGS. 5a to 5c, when the menu key 14a is manipulated, the operation mode is shifted into a smart phone using mode as shown in FIGS. 7a to 8c. At this time, the operation mode is at first shifted into a mail preparing mode shown in FIG. 7a. In this mail preparing mode, a manipulation part composed of character keys and touch keys, for preparing a mail is displayed on the multicolored liquid crystal display part 11, and accordingly, a mail can be prepared by touching the character keys. During this mail preparation, Kana characters, alphanumeric characters or symbolic marks can be selected. The content of the prepared mail is displayed on the see-through liquid crystal display part 10, and accordingly, the content of the mail can be confirmed.

At this stage, the manipulation key 12a serves as a memory key, and accordingly, after a desired mail content is obtained, the content is stored in the memory by manipulating the memory key 12a. Further, the content of the mail can be stored in a memory area in the server which is designated to the portable information communication terminal unit. Another portable information communication terminal unit can access this memory area. Thus, the mail can be sent to an operator for this another portable information communication terminal unit.

When the mode key 13a is manipulated in the mail preparing mode shown in FIG. 7a, the operation mode is shifted into a mail receiving mode shown in FIG. 7b. In this mode, by this information communication terminal unit, a mail stored in a memory area designated to another portable information communication terminal unit in the server, as mentioned above, is read, and the reading is carried out by voice through the intermediary of a speaker 15, and the content of the mail is displayed on the multicolored liquid crystal display part 11. During reading of the mail, adjustment for increasing and decreasing the speed of reading can be made by using the "▲" touch key or the "▼" touch key,

11

and further, a pause in reading, and retuning or advancing of reading can be made by using a "crosswise triangular mark/two vertical bar mark" key, "two rightward triangular mark" key or "two leftward triangular mark" key.

When the reading of the mail stored in the server is completed, the reading of the mail is repeated again. Further, if the mode key 13a is manipulated in this mail receiving mode, the operation mode is shifted into a schedule managing mode shown in FIG. 7c. In this mode, a schedule for the operator himself is prepared, and the thus prepared schedule is displayed on the multicolored liquid crystal display part 11. In this case, the manipulation key 12a serves as an update key. By manipulating this update key 12a, a part of the schedule which have been already prepared can be updated, and further, by touching a "new entry" key, a new schedule can be added. The thus updated schedule and a newly entered schedule are sent into a memory area in the server, which is designated for the portable information communication terminal unit, and this memory area can be informed to an operator having a portable information communication terminal unit which can access this memory area.

In this schedule managing mode, when the mode key 13a is manipulated, the operation mode is shifted into an information acquiring mode shown in FIGS. 8a, 8b, 8c. In this mode, a desired information can be obtained through an internet from service companies for which the operator has entry. When this mode is effected, a list-up of information genres is displayed on the multicolored liquid crystal display part 11 as shown in FIG. 8a. In the display of this list-up, a selected information is highlighted by a half-tone dot meshing, and accordingly, by manipulating a scroll touch key displayed on the multicolored liquid crystal display part 11, a selection of a desired information and the scroll of the list-up display can be made, in a manner similar to that explained with reference to FIG. 5b.

At this time, the manipulation key 12a serves as an access key, and accordingly, if, for example, an item "2. Traffic Information" is selected, as shown, the names of service companies for this traffic information is displayed on the see-through liquid crystal display part 10, and accordingly, by manipulating the access key 12a, one of the service companies can be selected. At this time, by touching "sending" key displayed on the multicolored liquid crystal display part 11, it can access the service company, and accordingly, as shown in FIG. 8b, a traffic information provided by the service company can be displayed on the multicolored liquid crystal display part 11.

In the information acquiring mode shown in FIGS. 8a and 8b, when the mode key 13a is manipulated, the operation mode is shifted into a navigation mode shown in FIG. 8c. In this mode, a navigation information can be obtained from a GPS, and a navigation screen can be displayed on the multicolored liquid crystal display part 11. In this case, for example, a navigation information can be selected in accordance with a kind such as "Recommendation", "Nearness", "NEW" or the like. Further, on the see-through liquid crystal display part 10, an azimuth compass for indicating an azimuth at the present position, and a required time up to a shop or a facility in accordance with the above-mentioned kind in a map displayed on the multicolored liquid crystal display part 11 are also displayed.

In each of the modes shown in FIGS. 8a to 8c, if the menu key 14a is manipulated, the operation mode is returned into a portable telephone sending mode.

Although the embodiment of the present invention has been explained, the present invention should not be limited

12

to this embodiment, but may be applied in any other configuration. Further, the kinds of modes and the setting order which can be effected by manipulating the mode key 13a, and the kinds of modes and the setting order which can be effected by manipulating the menu key 14a should not be limited to those in the above-mentioned embodiment.

Further, in the above-mentioned embodiment, the video camera is provided in the coupling part between the outer casings 1, 2. However, according to the present invention, the position at which the video camera is provided should not be limited to this part, but the video camera may be provided any other position such as an end part on the outer casing 1 side remote from the coupling part 5. However, even in this case, it goes without saying that an arrangement should be taken such as to enable the direction of the video camera to be changed over a sufficiently wide angular range, and to enable the outer casing 1, 2 to be closed.

What is claimed is:

1. A portable information terminal unit comprising a first and a second casing, each of said first and second casings having a longitudinal proximal end and a longitudinal distal end, hinge means for coupling said first and second casings at the respective longitudinal proximal ends thereof with each other so that said first and second casings are rotatable relative to each other, an opening piercing through said first casing, a see-through first liquid crystal display part fitted in the opening, a second liquid crystal display part provided in said second casing, means for detecting opening of said first and second casings relative to each other, control means for longitudinally reversing an image on said see-through liquid crystal display part in response to a detection by said detecting means, a speaker provided in said first casing near to the distal end thereof, and a microphone provided in said second casing near to the distal end thereof, wherein said see-through first liquid crystal display part and said second liquid crystal display part are overlapped with each other when said first and second casings are closed to each other.

2. A portable information terminal unit as set forth in claim 1, wherein said see-through first liquid crystal display part is a monochromatic liquid crystal display part, and said second liquid crystal display part is a multi-colored liquid crystal display part.

3. A portable information terminal unit as set forth in claim 1, wherein said see-through first liquid crystal display part is superposed over its entirety with a part of said second liquid crystal display part so as to allow the part of said second liquid crystal display part to be seen through said see-through first liquid crystal part when said first and second casings are closed to each other.

4. A portable information terminal unit as set forth in claim 3, wherein said see-through first liquid crystal display part is a monochromatic liquid crystal display part, and said second liquid crystal display part is a multi-colored liquid crystal display part.

5. A portable information terminal unit comprising a first and a second casing, each of said first and second casings having a longitudinal proximal end and a longitudinal distal end, hinge means having a center axis for coupling said first and second casings at the respective longitudinal proximal ends thereof with each other so that said first and second casings are rotatable relative to each other, a video-camera rotatably mounted to said hinge means, an opening piercing through said first casing, a see-through first liquid crystal display part fitted in the opening, a second liquid crystal display part provided in said second casing, means for detecting opening of said first and second casings, relative to each other, control means for longitudinally reversing an

13

image on said see-through liquid crystal display part in response to a detection by said detecting means, a speaker provided in said first casing near to the distal end thereof, and a microphone provided in said second casing near to the distal end thereof, wherein said see-through first liquid crystal display part and said second liquid crystal display part are overlapped with each other when the first and second casings are closed to each other, and said video-camera is rotatable around the center axis of said hinge means independent from said first and second casings for picking up an image which is displayed on said second liquid crystal display part.

6. A portable information terminal unit as set forth in claim 5, wherein said see-through first liquid display part is superposed over its entirety with a part of the second liquid display part so that the part of the second liquid crystal display part can be seen through said see-through first liquid crystal display part.

7. A portable information terminal unit as set forth in claim 5, wherein said see-through first liquid crystal display part is a monochromatic liquid crystal display part, and said second liquid crystal display part is a multi-colored liquid crystal display part.

8. A portable information terminal unit as set forth in claim 5, further comprising means for latching said first and

14

second casings at a predetermined angle, wherein said see-through first liquid crystal display part is used as a finder when said first and second casings are opened from each other, and an image picked up by said video-camera is displayed on said second liquid display part.

9. A portable information terminal unit as set forth in claim 5, wherein characters are displayed on said see-through first liquid display part while an image is displayed on said second liquid display part, and the characters on the see-through first liquid crystal display part and the image on said second liquid crystal display part can be seen being overlapped with each other when the first and second casings are closed to each other.

10. A portable information terminal unit as set forth in claim 6, wherein characters are displayed on said see-through first liquid display part while an image is displayed on said second liquid display part, and the characters on the see-through first liquid crystal display part and the image on said second liquid crystal display part can be seen being overlapped with each other when said first and second casings are closed to each other.

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